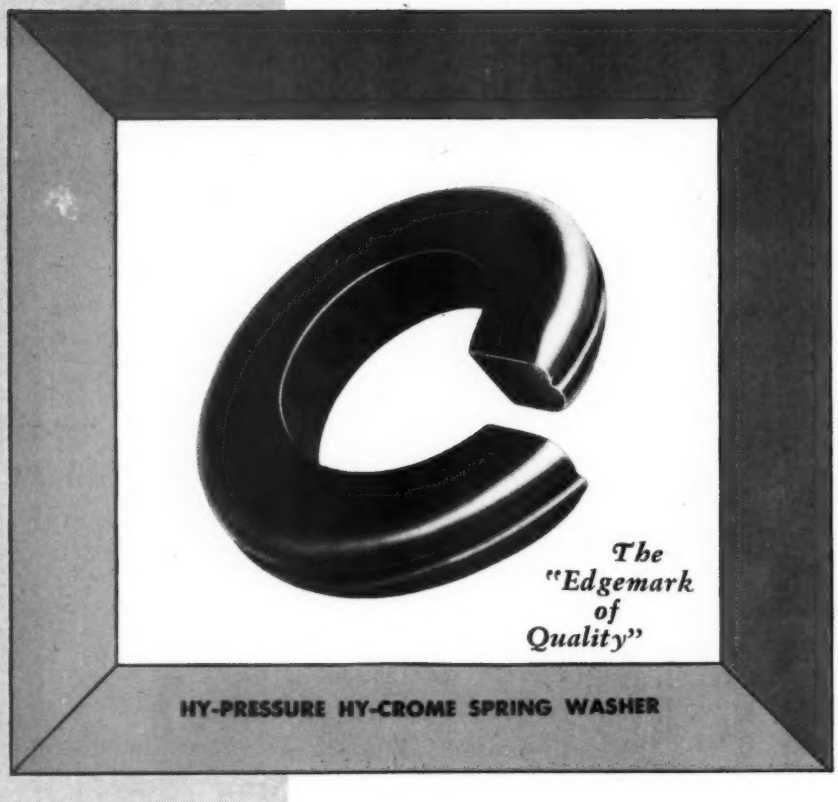
Railway Engineering and Maintenance

APRIL, 1945



There's more here than meets the eye!

- It looks like a SPRING WASHER . . . it feels like a SPRING WASHER . . . but can you rely on it to perform efficiently and economically as a SPRING WASHER? CERTAINLY!
- RELIANCE HY-PRESSURE HY-CROME SPRING WASHERS have been developed only after laboratory research and exhaustive field tests wtih the helpful cooperation of many railroad users.
- Today RELIANCE HY-PRESSURE HY-CROME SPRING WASHERS exceed A.R.E.A. requirements for reactive pressure, reactive range and non-fatiguing service and possess inherent qualities not evident to the naked eye.
- If you are not acquainted with the HY-CROME SPRING WASHER FAMILY take advantage of this opportunity to write for descriptive folders or have a service engineer call at your convenience. HY-CROME SPRING WASHERS equal to meeting the requirements of every specific track application are available. In every one there's more quality than meets the eye.

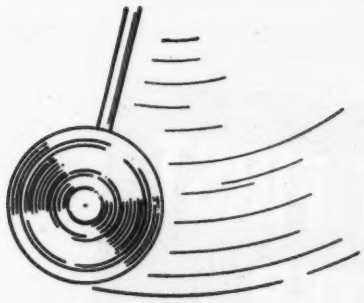
EATON

EATON MANUFACTURING COMPANY

MASSILLON, OHIO *Reliance Division*

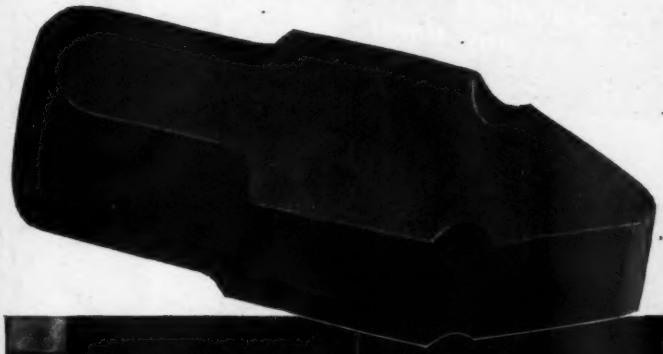
Sales Offices: New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal

Published monthly by Simmons Boardman Publishing Corporation, 105 W. Adams St., Chicago 3, Ill. Subscription price: United States and Possessions, and Canada, $2.00; Foreign, $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933, at the post office at Chicago, Ill., under the act of March 3, 1879, with additional entry at Mount Morris, Ill., post office. Address communications to 105 W. Adams St., Chicago 3, Ill.



tick-tock...tick-tock

ANOTHER WARREN SLEDGE READY



At Warren Tool, specialized equipment and experience eliminate heat treating pitfalls. *Automatic* time and temperature controls regulate the heating cycle both for hardening and tempering. **A special quenching mechanism** directs a powerful stream of coolant against the striking surfaces, resulting in uniform hardness. Selected steels to our own specification, plus careful forging and finishing operations, prior to heat treating, develop the best structure for heat treating the tool.

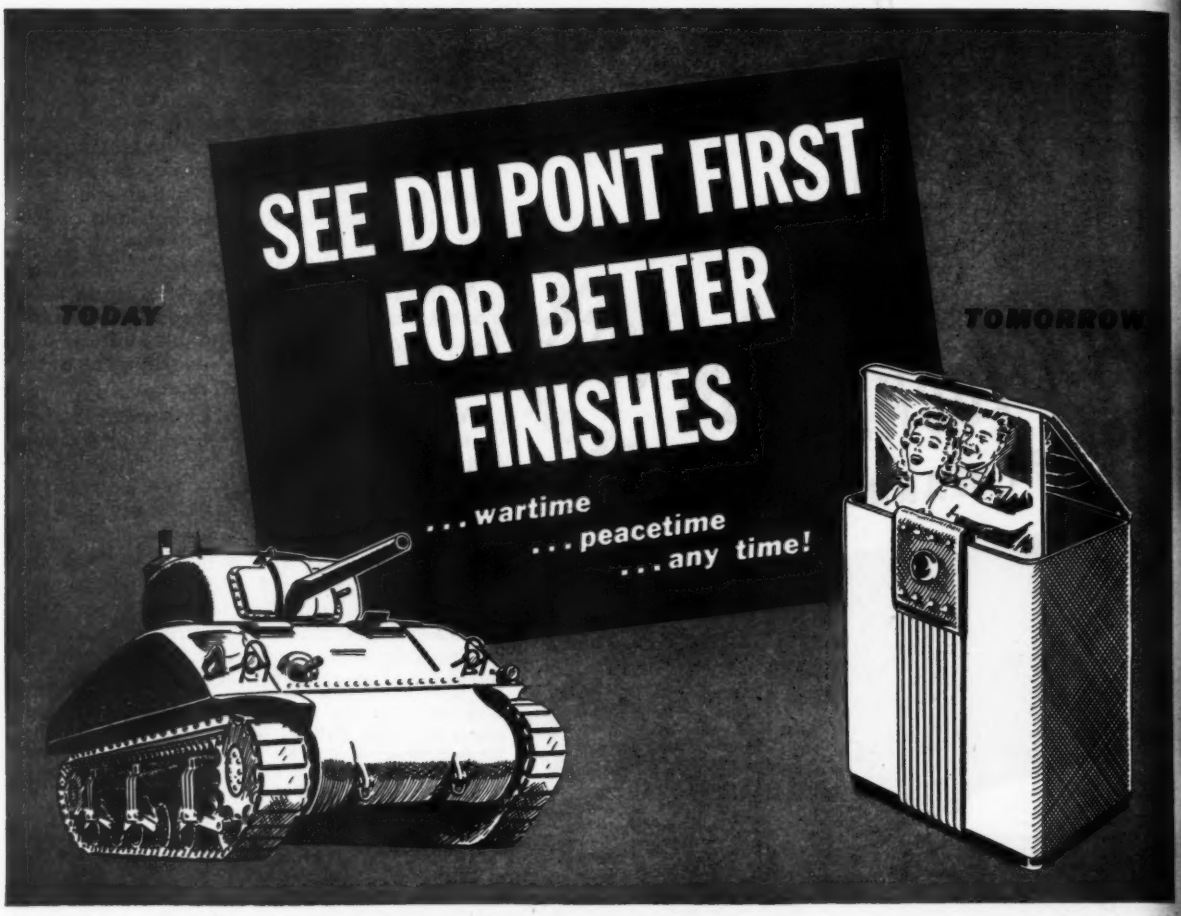
As the result of the exercised care in each manufacturing step, Warren-teed Heavy Hand Tools have sharp, dependable edges and bevels, true striking faces, excellent balance, and they give long, safe service.

Warren Tool Corporation, pioneer in the use of alloy steels for heavy hand tools, manufactures sledges, mauls, picks, mattocks, adzes, track chisels, and other heavy hand tools *exclusively* for the hardware and railway industries.

Warren Tool is the manufacturer of the famous Devil Line of chisels, mauls, and sledges, made from alloy tool steels, correctly forged and heat treated. All striking faces and cutting edges are ground to templets for just the right angle or bevel and heat treated.

Automatic time and temperature controls together with proper quenching methods give each Warren-teed sledge the right degree of hardness for long, dependable, and safe service. Sledges are one of the many heavy hand tools made by Warren Tool Corporation.

WARREN TOOL CORP. • WARREN, OHIO



DO YOU HAVE a wartime finishing problem? See Du Pont first. Do you have a *peacetime* finishing problem? Again—see Du Pont first. For Du Pont sets the pace in paints. Remember? It was Du Pont pacemaking that revolutionized the industrial world with DUCO and DULUX. These famous finishes will continue to be standard equipment for a wide range of products—autos, refrigerators, furniture, kitchen equipment, and the like.

Du Pont war service is at *your* service. Since Pearl Harbor, Du Pont finish engineers (skilled experts) and the Du Pont Research Laboratories have helped hundreds of war industries break bottlenecks, and step up production. Call on these Du Pont "trouble-shooters" whenever you need them. Or if your finishing problem concerns the future and your product-to-be, they'll be glad to help you out on that one, too—provided it does not interfere with the war effort. If you're planning your product now, then *now* is the time to start thinking about the finish!

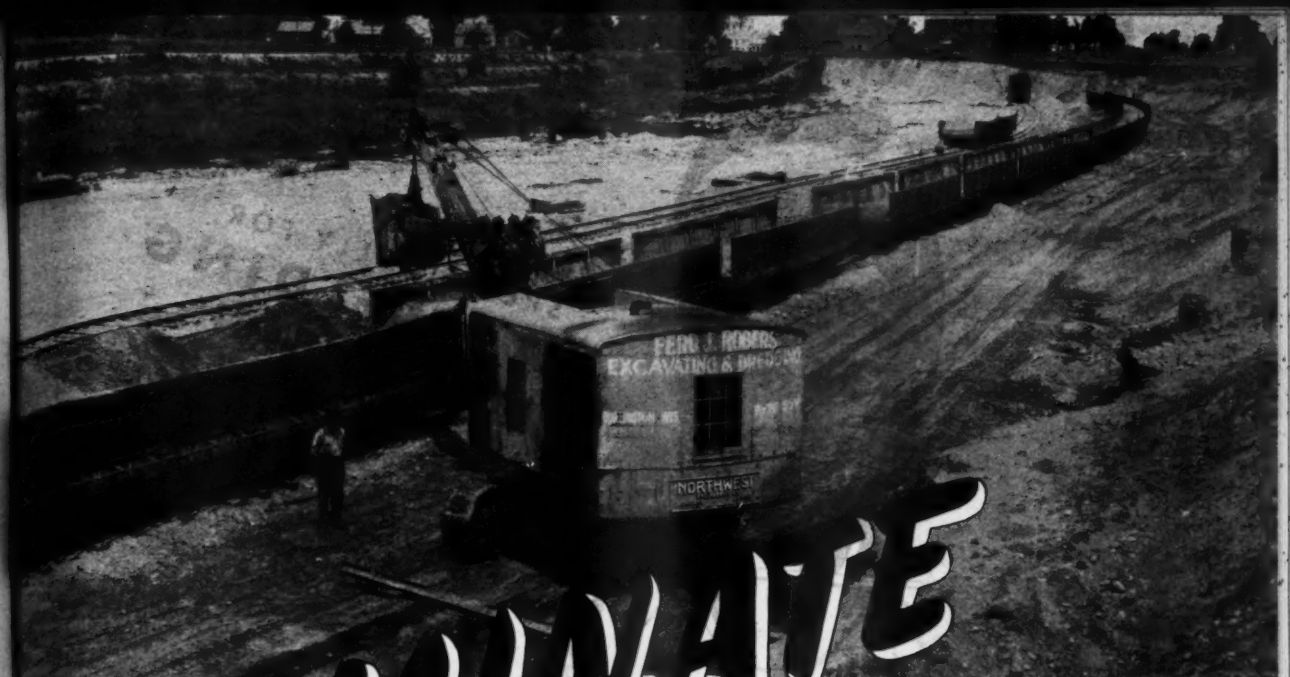
E. I. du Pont de Nemours & Co. (Inc.), Finishes Division, Wilmington 98, Delaware.

DU PONT

FINISHES DIVISION

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

DU PONT



ELIMINATE the SPOTTING ENGINE!

It used to take six men and a spotting engine to get out ballast for the Chicago Milwaukee and St. Paul R. R. in this pit at Paragon, Montana.

A Northwest Shovel made it possible to spot the cars in the morning and free the locomotive for other work. The shovel moves along the face of the bank loading as it goes. The Northwest easily loaded five cars an hour and 50,000 yards of material are moved before it is necessary to shift the track.

Perhaps you have a similar problem where economies can be affected. There is a Northwest size for every railroad use.

NORTHWEST ENGINEERING COMPANY
1713 Steger Bldg., 28 E. Jackson Blvd.
Chicago 4, Illinois

NORTHWEST

THE ALL PURPOSE RAILROAD MACHINE
SHOVEL • CRANE • DRAGLINE • PULLSHOVEL

DESIGNED SPECIFICALLY FOR **AC WELDING of CAST IRON**

Announcing a New

P & H "HARCAST"

Entirely New... Entirely Different!

● Perhaps you've wondered why such an all-around electrode for welding cast iron was not available. So did P&H research engineers. And they went to work on it!

It took nearly three years. But now it's ready ... ready to end your worries about weld cracks, poor penetration, excess porosity or pulling away at the fusion zone. It produces sound, dense welds with a tensile strength of 60,000 lbs. p.s.i.— approximately twice that of a good grade of cast iron. And it fuses well with mild or medium carbon steels for joining to cast iron.

Can Be Used at Low Amperages

Low amperage welding with "Harcast" minimizes the dilution at the fusion zone, improves machining qualities. It's easy to use, too, for single or multiple pass work. But its operating characteristics are entirely different.

An All-position Electrode — for Both AC and DC Welding

You can use P&H "Harcast" in all positions; downhand, vertical or overhead. Although designed primarily for AC welding, it works equally well on DC. But why not get full information? Try it yourself and see the difference! Write for literature.

A COMPLETE ARC WELDING SERVICE

P & H

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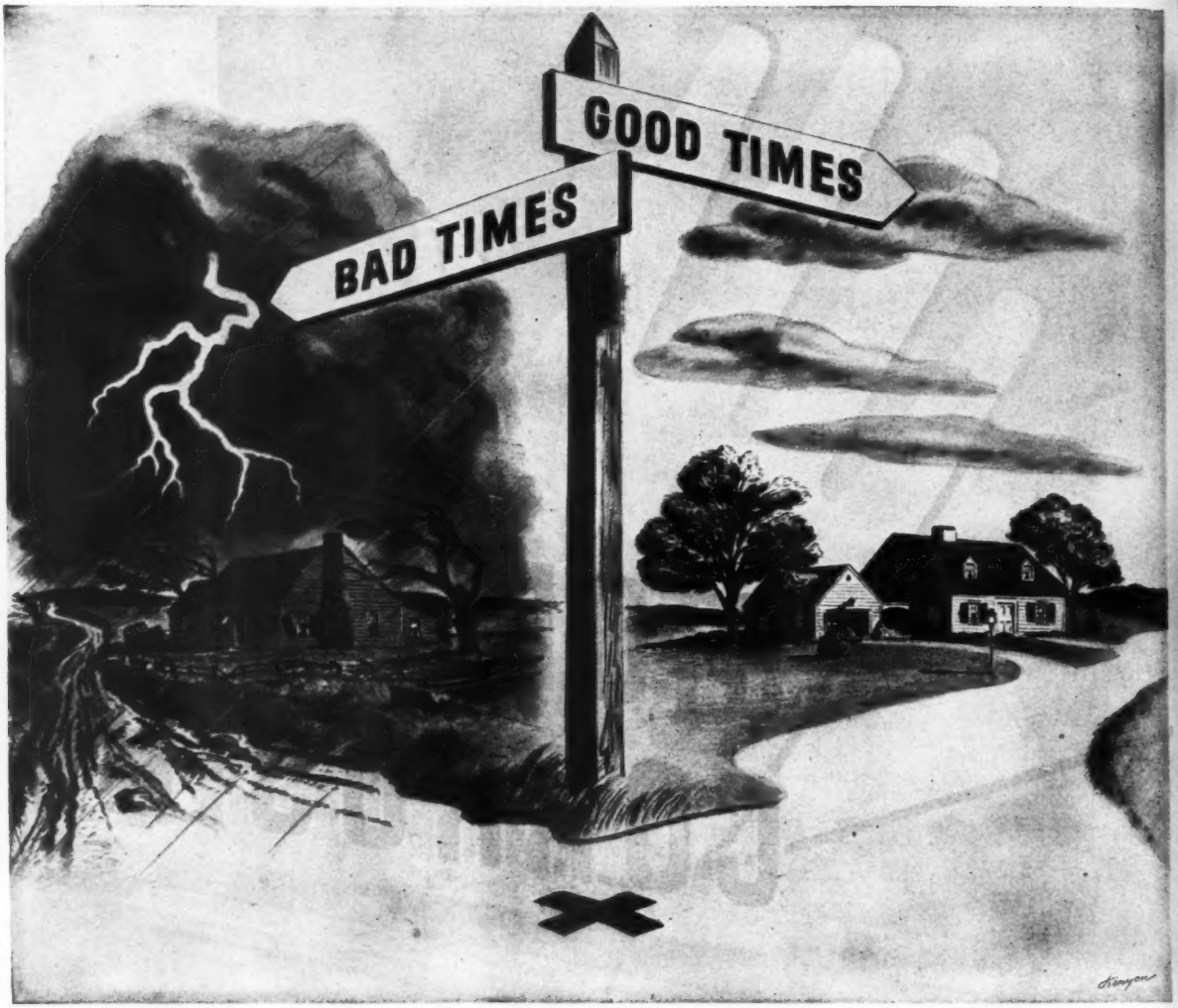
HOISTS • WELDING ELECTRODES • MOTORS P&H EXCAVATORS • ELECTRIC CRANES • ARC WELDERS



Here's where you stand today!

Look ahead a year or two...for your own sake.

Over on the dark side is this: Every unnecessary thing you buy helps shove the country one step nearer inflation and the bad times that come in inflation's wake.

Over on the bright side is this: Every single cent you save helps move you and your country one step nearer the kind of prosperous, happy, post-war America you want.

Okay—you're human. You're thinking mainly about yourself.

YOU SHOULD. Because if every man Jack (and every girl Jill) buys nothing he can get along without . . . (avoids Black Markets and "just-a-little-above-the-ceiling" like the plague!) . . . pays off the mortgage or any other debts . . . takes out more insurance . . . builds a healthy sock of savings . . . buys and holds more War Bonds—inflation will stay away from our door.

And Jack and Jill will be in a sound position no matter what times come.

Maybe you ought to clip this signpost and paste it in your pocketbook as a reminder that you can BUY your way to bad *times. Or you can SAVE your way to* good *ones.*

That's where YOU stand today.

4 THINGS TO DO to keep prices down and to protect your own future!

1. Buy only what you really need.

2. When you buy, pay no more than ceiling prices. Pay your ration points in full.

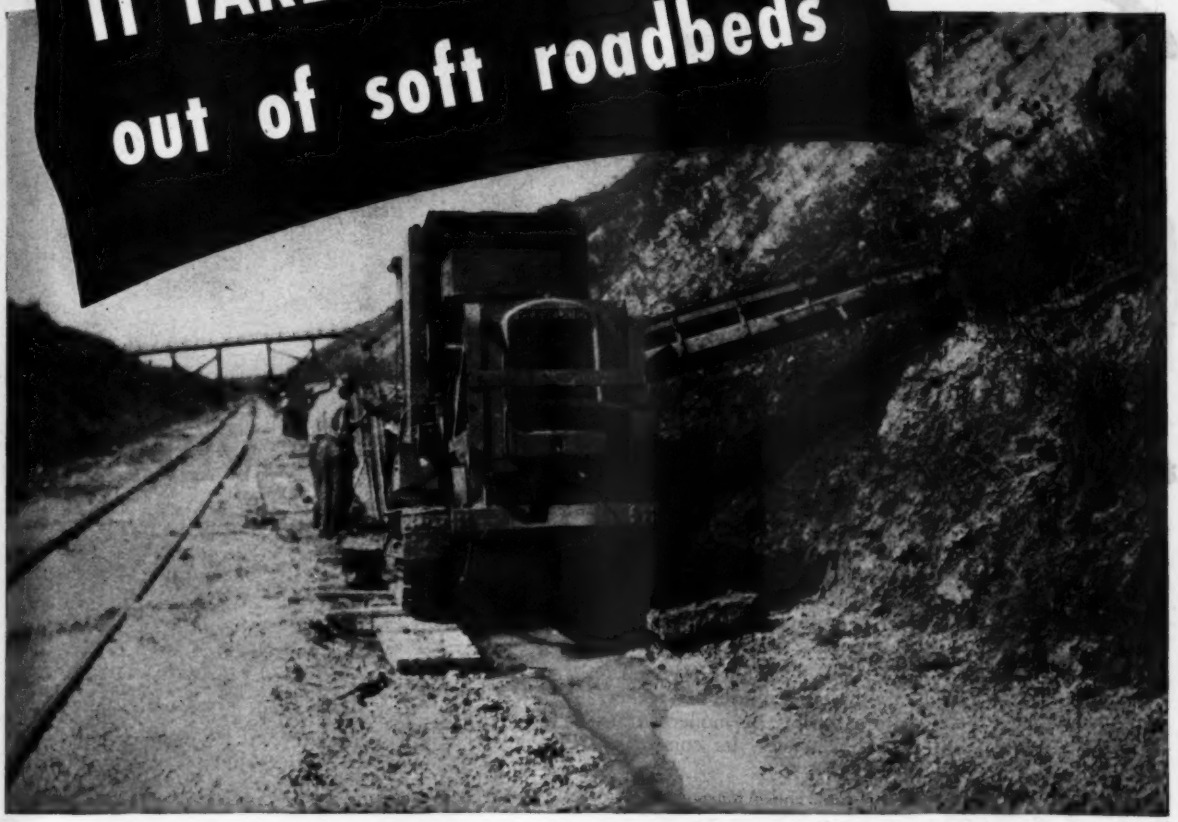
3. Keep your *own* prices down. Don't take advantage of war conditions to ask more for your labor, your services, or the goods you sell.

4. *Save.* Buy and hold all the War Bonds you can afford—to help pay for the war and protect your future. Keep up your insurance

HELP US KEEP PRICES DOWN

A United States War message prepared by the War Advertising Council; approved by the Office of War Information; and contributed by this magazine in cooperation with the Magazine Publishers of America.

IT TAKES THE SHIMMY out of soft roadbeds



Slides and saturated subgrade once made this 3000-foot cut troublesome to an important freight line in the West. Here workmen are installing 8-inch ARMCO Perforated Pipe at 9-foot depth, backfilling with gravel and sealing the top with clay to prevent entrance of surface-water.

Water pockets are unwelcome bedpartners on any rail line. They soften the subgrade, give roadbeds the fidgets, and are a constant source of worry and expense.

Strong, tight-jointed ARMCO Perforated Pipe is a sure cure. Proper use of this durable pipe assures fast, efficient subdrainage—either in old or new roadbeds.

For years this western rail line was plagued by trouble-making groundwater. Maintenance costs were high. So engineers installed ARMCO Perforated Pipe. Now, thanks to a firm dry subgrade, it costs far less to keep the roadbed in top shape. It will *stay that way too.*

ARMCO Perforated Pipe resists crushing and disjointing. Flexible, corrugated metal design and strong, tight joints see to that. It ends your worries over traffic vibration, heavy loads, shifting soils or frost action.

This sturdy pipe is easy to install. No special tools are needed. Long lengths are quickly joined by sturdy coupling bands to form a strong, trouble-free conduit. The job soon pays for itself in lower maintenance costs. Ask us for the facts. Write the Armco Railroad Sales Co. Incorporated, 281 Curtis Street, Middletown, Ohio, or to our nearest district office.

ARMCO

ARMCO PERFORATED PIPE

Tampers for ANY BALLAST and ALL LIFTS

Whatever the lift or nature of the ballast, tamping with the JACKSON ***vibratory*** Tamper will provide closely-fitted, interlocked ballast, that assures sound track and good drainage . . . The ***interchangeable blade*** feature of JACKSON Tampers affords an unusually wide range of tamping utility. Check the illustrated blades for use in specific ballast requiring a given amount of raise.

Left — No. U-606, 6" wide is tops for surfacing in gravel, rock or slag ballast up to 1½" in size in normal lifts. Also efficient in spotting operations in light ballasts.

Right — No. U-600, 9" wide gravel blade, is the fastest of the JACKSON blades, provided sufficient lift is afforded, because large quantities of ballast can be carried to fill pockets opened by blade insertion. Good for high lifts in all ballasts, low or moderate lifts in light ballasts.

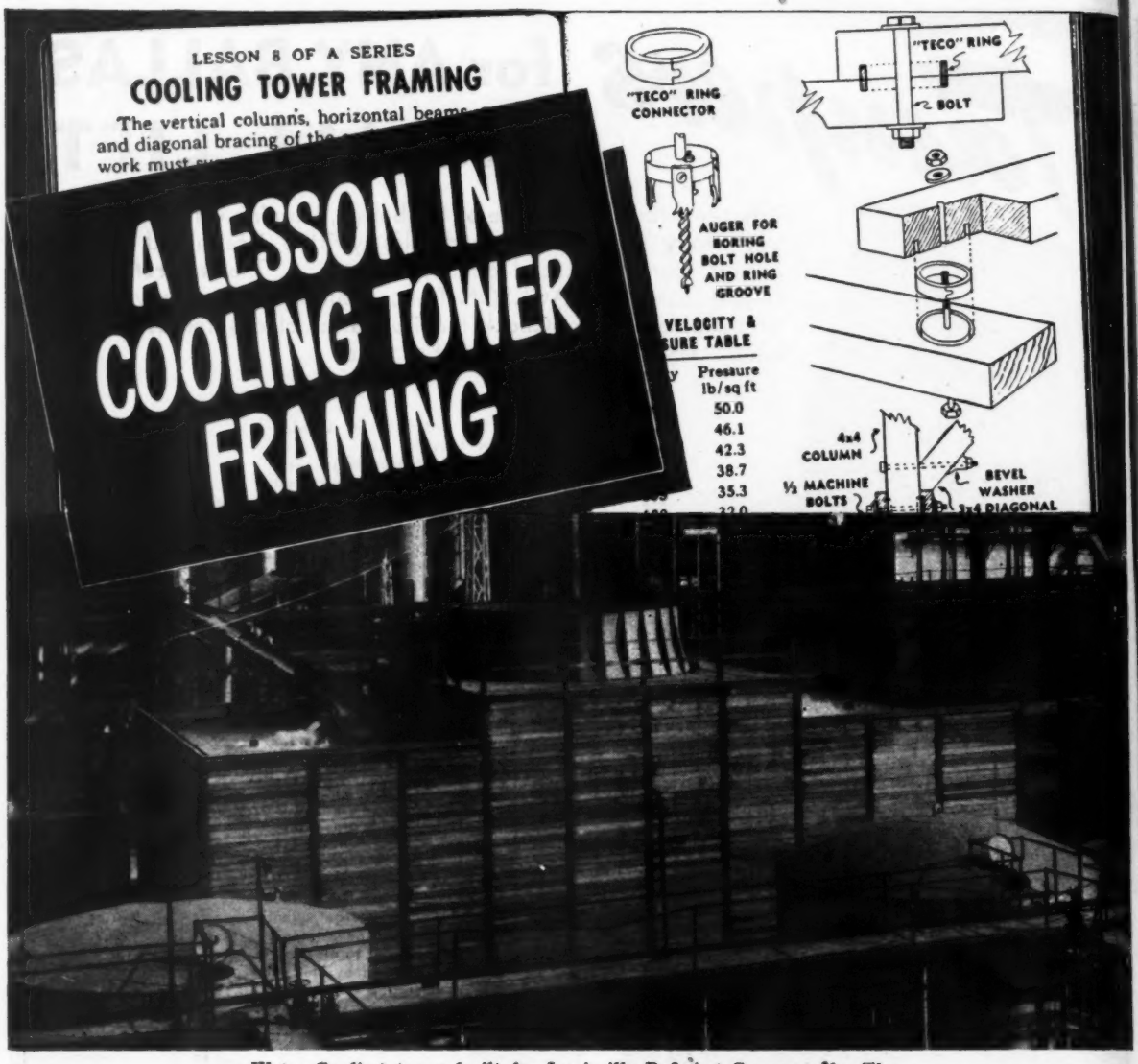
Above — No. 1-A L & R Step-cut blade is the most generally used JACKSON blade because of its exceptionally wide tamping range, in low or medium lifts. Performs excellently in all types of ballast.

No. U-609 blade for fast digging and removal of old ballast in skeletonizing or when tie renewals are made. Effective in digging out water pockets, removing ice from platforms, switches, frogs and flangeways. This JACKSON blade will equal the work of several men with picks.

JACKSON

vibratory tampers are standard on the majority of the country's leading railroads. Their superiority is based on the adaption of vibration to ballast tamping, a principle originated by JACKSON — the sole manufacturer of ***vibratory*** Tampers. Write for literature describing Jackson Tampers and how to use them.

ELECTRIC TAMPER & EQUIPMENT CO., LUDINGTON, MICH.



Water Cooling tower built for Louisville Refining Company by The Marley Company, Inc., Kansas City, Kansas and Stockton, California.

The Marley Company, one of the leading cooling tower manufacturers in the U. S., specifies and uses TECO connectors in its cooling tower framing. A section of the Marley cooling tower manual and a photograph of a Marley cooling tower are illustrated above.

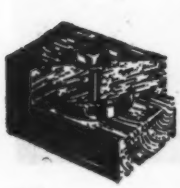
Louisville Refining Company, Louisville, Kentucky, for whom this tower was built, states, "The inside framework is of much more rugged construction than we at first anticipated, especially the manner of reinforcing the joints with steel collars."

This water cooling tower is built of Redwood lumber. Framing is joined at all critical points with TECO connectors, standard equipment on Marley built cooling towers.

Just another example of the strong, sound, practical jobs being built with the help of TECO TIMBER CONNECTORS. Write us for informative literature.

TIMBER ENGINEERING COMPANY of WASHINGTON, D. C.

WASHINGTON • CHICAGO • NEW ORLEANS • SAN FRANCISCO



Specify **TECO**

CONNECTORS AND RODS

Endorsed by Leading Lumber Manufacturers and Fabricators

FOREIGN DISTRIBUTORS:

V. H. McIntyre, Ltd., Toronto, Canada • MacAndrews & Forbes, Ltd., London, England • Timber Engineering Company, Sydney, Australia Morle & Company, Ltd., Wellington, New Zealand • The Ford Company, Inc., Panama City, Panama • Standard Machinery & Supply Company, Mexico, D. F.

Sure-footed!

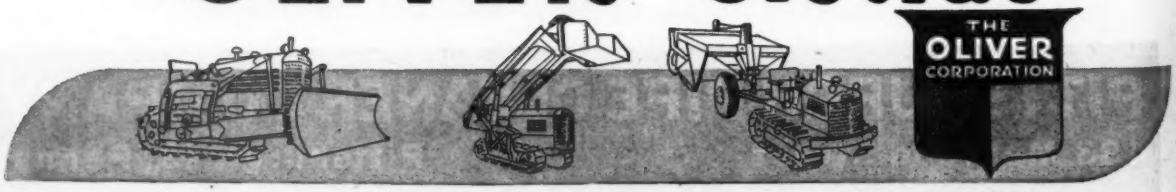
● Downhill or up . . . turns or straightaway, Oliver "Cletrac" crawler tractors have a sure-footed grip. Even when taking a heavy load downhill, they don't zigzag. Power is never disconnected from either track . . . both tracks keep working all the time to assure perfect control, even on turns.

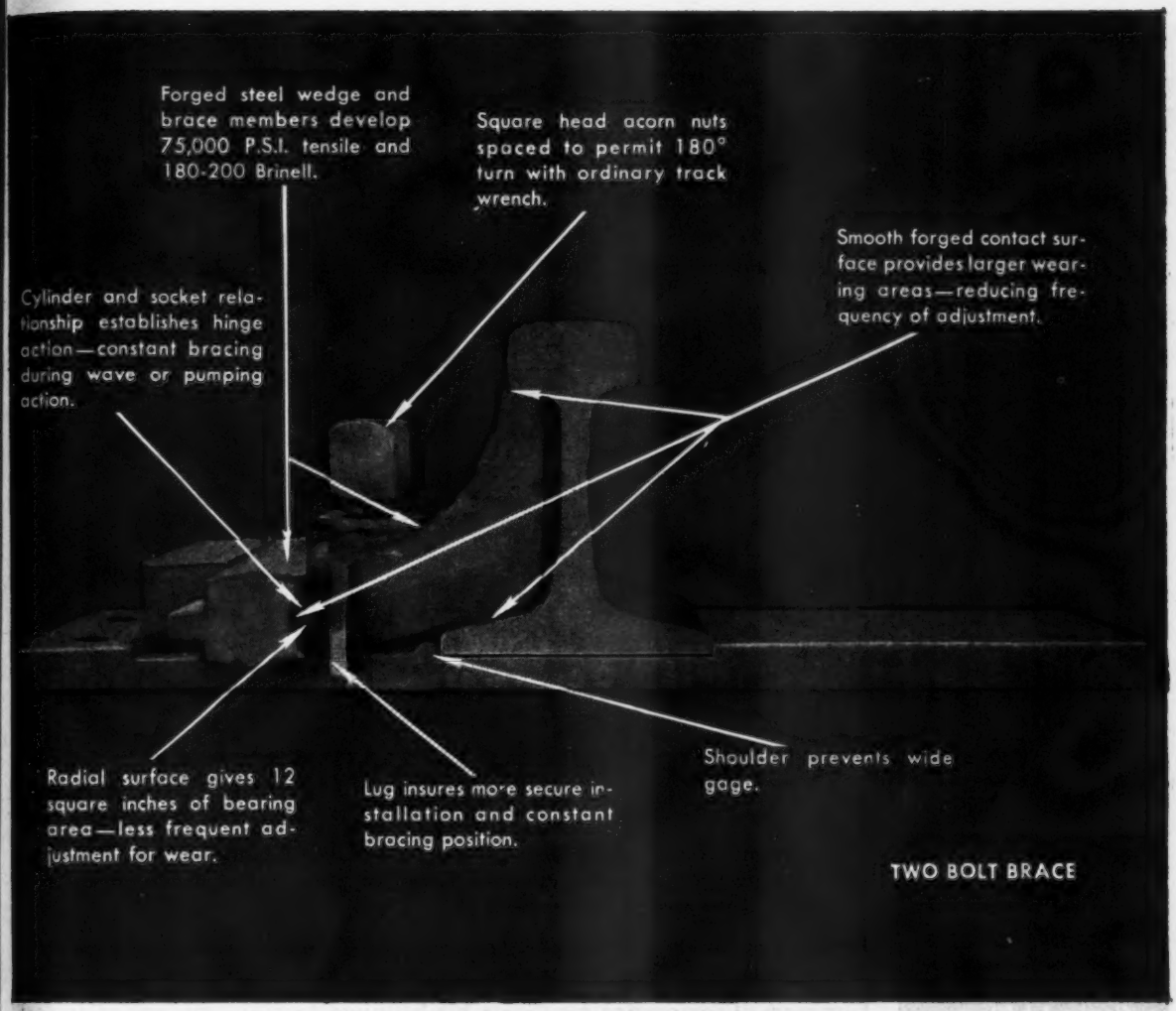
This sure-footed grip, which assures greater safety on hills and turns, is found only on Oliver "Cletracs." For only Oliver "Cletrac" gives you *controlled differential steering* . . . the exclusive feature that eliminates "declutching" or "braking" on turns . . . that enables Oliver "Cletracs" with a heavy load to steer the same going downhill as up. There is no need for the operator to "cross over" on the controls and steer in the opposite direction as is necessary on the ordinary tractor.

These sure-footed tractors are unusually accessible, making maintenance a simple task. They are ruggedly built for long life and greater resistance to the shocks, strains and twists of tractor service.

Substantial numbers of Oliver "Cletrac" tractors are now being released for essential use. Your Cletrac dealer will gladly assist you in making application for a new tractor. • **The OLIVER Corporation,** Industrial Division: 19300 Euclid Avenue, Cleveland, Ohio.

OLIVER - Cletrac

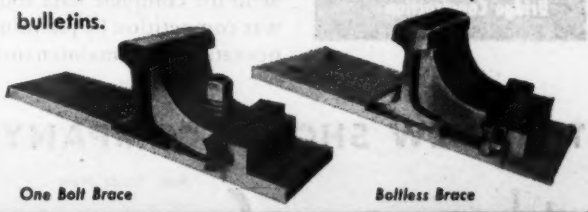




Pettibone Mulliken

Forged ADJUSTABLE RAIL BRACES

Constant and effective bracing to the rail, maximum service life with minimum maintenance keynote Pettibone Mulliken Corporation's line of Forged Adjustable Rail Braces. Their greater strength, longer life and reduced need for maintenance make them a *must* installation on those railroads looking to future savings under postwar competitive conditions. While the fundamental design is the same, they are supplied in three variations: the two bolt brace, one bolt brace, and boltless brace. Write for descriptive bulletins.



One Bolt Brace *Boltless Brace*

Quality Since 1880

PETTIBONE MULLIKEN CORPORATION

4710 West Division Street, Chicago 51, Illinois

LORAIN CRANES, SHOVELS offer basic economies to help you meet postwar competition

Check this work list

- Handling Rails and Frogs
- Fueling and Auxiliary Coal Storage
- Cleaning Ash Pits
- Handling Scrap
- Storekeepers Yard and Road Service
- Cleaning Ditches
- Cleaning Ballast
- Team Track and Terminal Material Handling
- Heavy Lifts
- Bridge Construction

The chief engineer of a prominent railroad reports that ditching and bank widening can be done with off-track crawler-mounted draglines—like the Lorain at work above—at ⅛ the cost of former methods!

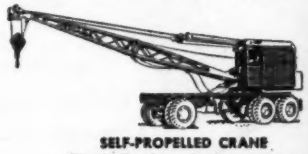
Here and on dozens of other jobs, Lorain cranes and shovels can help *you* cut costs, get the work done faster, and without interference to paying rail traffic.

Fifty years of engineering experience has built into Lorains a low operating cost, service dependability and versatility that make them tops for railroad use.

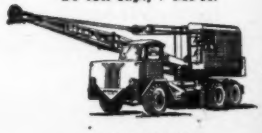
15 MACHINES IN ONE

Every Lorain—from the large and small crawler mounted machines to the rubber-tired Moto-Cranes and single engine, single operator, Self-Propelled Cranes can be used with these many different work attachments: magnets, clamshell buckets, dragline buckets, orange peel buckets, skips, grabs, concrete buckets, slings, grapples, skull crackers, hook blocks, tongs, hairpin hooks, clamps and special hooks.

Send for complete data today. Start meeting postwar competition by planning now to cut your basic operating and maintenance costs with Lorains!



SELF-PROPELLED CRANE
Single Engine, single operator, 20 ton cap., 7 MPH.



MOTO-CRANE
10, 15, 20 ton cap. 30 MPH.

THE THEW SHOVEL COMPANY • *LORAIN, OHIO*

Reg. Trade Mark
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CRANES • SHOVELS • DRAGLINES • MOTO-CRANES

IN THE BYRON JACKSON PNEUMATIC SPONGE

THE SIMPLE "CIRCLE S" RUNNER REDUCES WEAR — PREVENTS CLOGGING

Here's how

Point of greatest wear in any sump or sponge pump is in the runner and when pump chokes up the trouble is usually traceable to the same source. Constant replacements due to wear, as well as down time to clean pump, are materially reduced by incorporating the "Circle S" runner in the Byron Jackson Pneumatic Sponge.

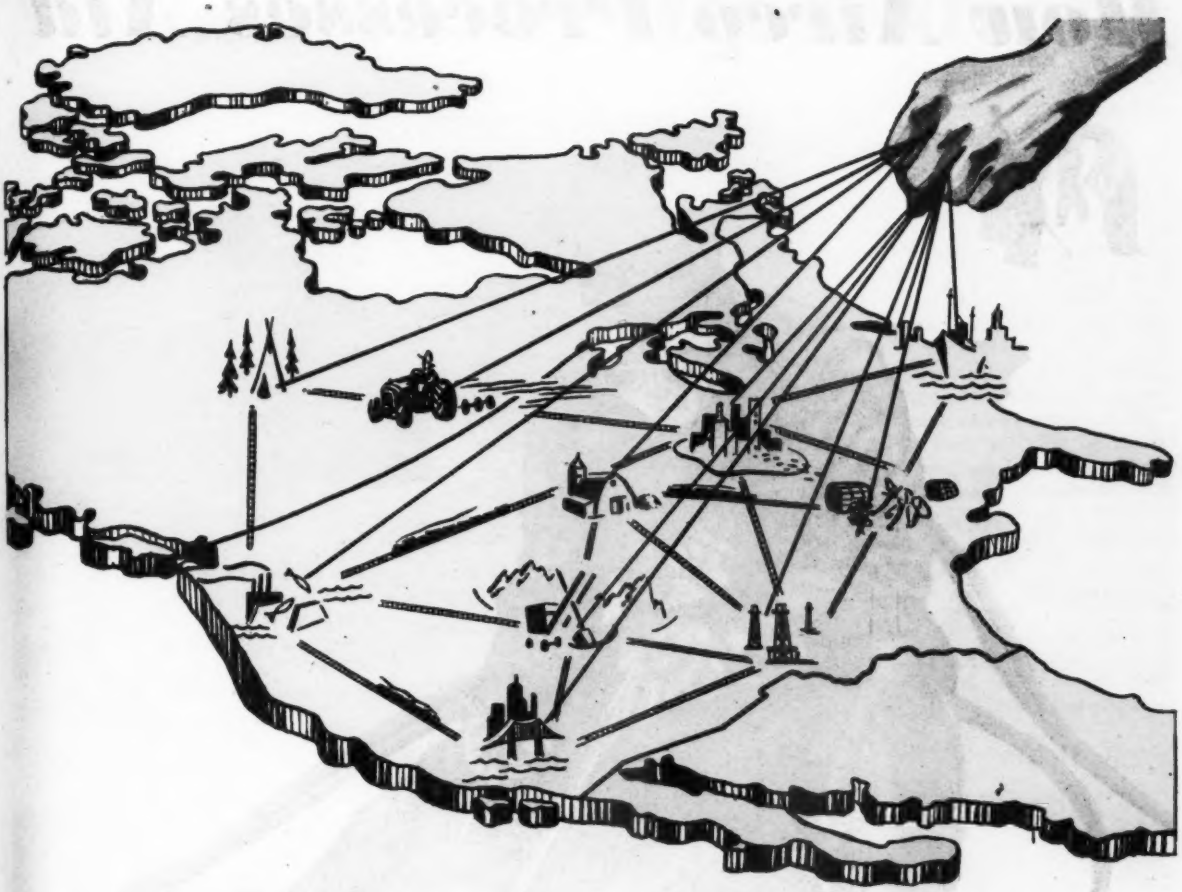
This two port impeller design, first of all, permits the easy passage through the pump, to the discharge port, of any spherical solid able to enter the eye or suction intake of the pump. Second, the curved vanes of the runner are so designed that sand, gravel and other abrasives, carried in suspension in the pumped fluid, do not directly impinge upon any one section of the runner, or pump case. Instead, easy, natural flow lines are followed from entrance to discharge ports, thereby minimizing possible wear.

Rugged, compact, yet light in weight (85 pounds), the Byron Jackson Pneumatic Sponge is suitable for operation in any position. Designed for pumping heads up to 150' in single stage and 300' in two stages, solids 9/16" in diameter may be handled in the 2-1/2" size and 1-1/8" through the 3" size. The Rotary air motor operates on compressed air at pressures from 70 to 100 psi. Write today for Pneumatic Sponge Bulletin.

ARMY E NAVY

BYRON JACKSON CO.

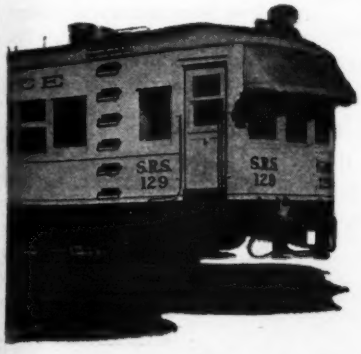
Houston • LOS ANGELES • New York



Coordinating A Continent

NEARLY three hundred thousand miles of railroad track form a great spider-web over the seven and one-half million square miles of land that is this continent. Over a million Americans earn their livelihood by serving the railroads of the country. This vast network ties a continent together—coordinates its wide-spread functions—and makes our countries an efficient unit.

American Railroads are famed the world over for their fine record of safety—and the wide-ranging Detector Cars of Sperry's famed yellow fleet are recognized as an important contributor to this safety record.



—A Sperry Contribution in Peace and War—

SPERRY
Rail Service

HOBOKEN, NEW JERSEY CHICAGO, ILLINOIS

How Airco Processes Aid M

UNDER the stress of severe wartime conditions, railroad maintenance men have placed greater reliance than ever on Airco time-proven oxyacetylene flame and electric arc methods. These processes are giving valuable aid both in restoring battered rail ends, worn frogs and switch points and in reconditioning maintenance tools and work equipment.

Airco's Applied Engineering Department will be glad to assist maintenance engineers on any problem involving the use of these and other Airco processes. For additional information call or write your nearest Airco office.

Building Up Worn Rail Ends . . . Long a standard method on many railroads, this economical oxyacetylene flame process is today proving doubly helpful in easing the problem caused by the scarcity of replacement rails.

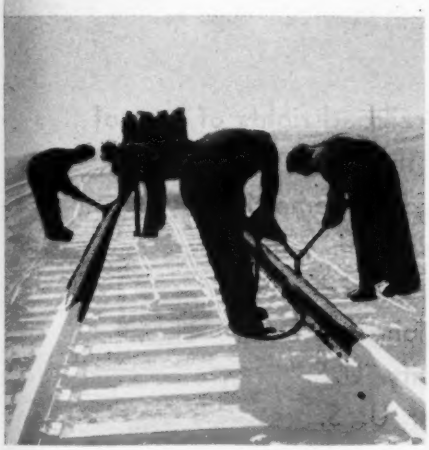
AIRCO

Maintenance Operations

Welding Fractured Angle Bars . . . This is one of many Airco methods for repairing irreplaceable materials. The fractured area in the bar is first cut out with an oxyacetylene torch. Then the bar is welded with Airco No. 93 Electrode. The bars are next reformed into head free bars and heat treated.

Building Up Worn Frogs . . . This economical method of building up worn frog points and wing rails is used more widely today than ever before. It not only renews the life of worn frogs, but it reduces traffic interruption to a minimum.

Rail Cropping . . . Rail ends are cropped quickly and neatly by this Airco-developed portable rail cropping machine.



End Hardening New Rails . . . New main line open hearth rails are end hardened in the field to prevent rail end batter. In this method, the rail ends are heated to about 1500° F. by oxyacetylene flame torches, quenched and then drawn to secure proper hardness.

2 Reasons why

RED LEAD

means Extra Rust Protection . . .

Why is Red Lead so widely accepted throughout industry as *The* metal protective paint?

Why are paints containing Red Lead so generally specified for safeguarding metal surfaces from the costly ravages of rust?

The reasons are many, but none are more noteworthy than Red Lead's ability to counteract acid conditions and to halt electrochemical action—both prime causes of rusting—as explained at right.

Still another important advantage of Red Lead is that it partially combines with the usual vehicles to form compounds generally known as "lead soaps." Due to their composition and the individual way in which these compounds form, the film obtained is highly water-resistant. In addition, lead soaps contribute to the formation of tough, elastic films that "stick on the job."

Remember, too, that Red Lead is compatible with practically all vehicles commonly used in metal protective paints, including phenolic and alkyd resin types.

Specify Red Lead for ALL Metal Paints

The value of Red Lead as a rust preventive is most fully realized in a metal paint where it is the only pigment used. However its rust-resistant properties are so pronounced that it also improves any multiple pigment paint. No matter what price you pay, you'll get a better metal paint if it contains Red Lead.

NEUTRALIZES ACID

1 Red Lead has the ability to counteract acid conditions which are recognized as accelerators of rust. Structural steel is exposed to such environments because acid forming compounds are carried by the atmosphere in the form of gas, smoke and moisture. Red Lead has a neutralizing effect on these conditions as it is essentially a *basic* pigment with the ability to develop and maintain, for a prolonged time, a mild alkaline environment at the surface of the metal. Authoritative tests show that, as a result, Red Lead inhibits the process of corrosion. In short, metal paints, too, should "stay on the alkaline side."

2 Another outstanding reason Red Lead means *extra* rust protection is the unique way it shields metal surfaces with a protective film. Rusting is fundamentally an electrochemical process in which weak currents are generated which cause iron to become soluble in the lowest state of oxidation. Red Lead has properties through which this iron is rapidly converted to a stable compound that forms an adherent film. The formation of this protective shield halts electrochemical action, thus preventing further corrosion.

Write for New Booklet

"*Red Lead in Corrosion Resistant Paints*" is an up-to-date, authoritative guide for those responsible for specifying and formulating paint for structural iron and steel. It describes in detail the scientific reasons why Red Lead gives superior metal protection. It also includes typical specification formulas. If you haven't received your copy, address nearest branch listed below.

* * *

The benefit of our extensive experience with metal paints for both underwater and atmospheric use is available through our technical staff.

NATIONAL LEAD COMPANY: New York 6, Buffalo 3, Chicago 10, Cincinnati 3, Cleveland 13, St. Louis 1, San Francisco 10, Boston 6 (National-Boston Lead Co.); Pittsburgh 30 (National Lead & Oil Co. of Penna.); Philadelphia 7 (John T. Lewis & Bros. Co.)

DUTCH BOY RED LEAD

No. 196 of a series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING CORPORATION
105 WEST ADAMS ST.
CHICAGO 3, ILL.

Subject: Delayed Deliveries

April 1, 1945

Dear Readers:

Many of you, I am sure, have noticed that certain of your copies of Maintenance have been coming to you later in the month than usual, and, no doubt, some of you have been inconvenienced or have at least wondered—why the delay? At the outset, let me tell you that there have been a number of reasons for this, all of which continue to prevail, and all of which appear to be beyond our control.

Most of you have assumed this to be the case and have been most considerate and understanding. This is evidenced by the fact that, to date, we have not received a single complaint or criticism. But the more so, for this reason, you deserve an explanation.

Like the railroads, everyone seems to be overloaded these days, and our printer, with one of the best-equipped and most efficient shops in the country, is no exception, with heavy commitments and a serious shortage of labor, which frequently see our make-up slowed down at every step more than ever before, and, not infrequently, presses standing idle, awaiting someone to operate them. Being also shorthanded, some of our advertisers or their agencies have helped hold up publication by delays in the receipt of their copy or plates, and the U. S. Postal Service, overloaded and undermanned, must likewise accept a share of the responsibility.

Why do we not go to press earlier each month, anticipating these delays? We could, but that would require closing our pages about the middle of each month prior to the date of publication, and holding out until the next issue all late news and developments, including some feature articles, expedients which we have felt undesirable from your standpoint.

These are the facts, in the face of which we solicit further indulgence and understanding on your part until conditions improve. On the other hand, you are entitled to your copy of Maintenance immediately after the first of each month and, to the extent that it is within our control, we intend to see that you get it.

Sincerely,

Neal D. Howard

Editor

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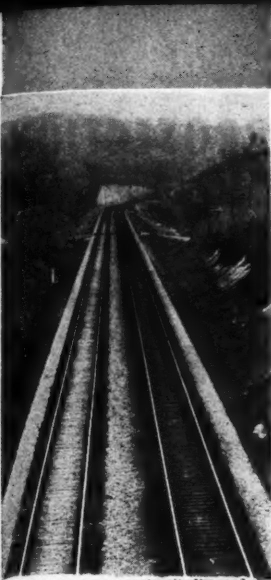

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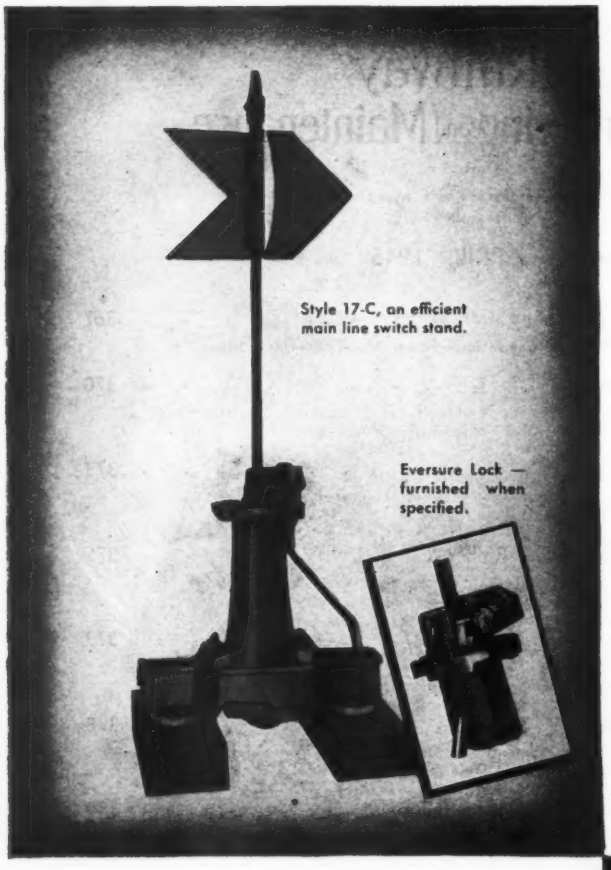

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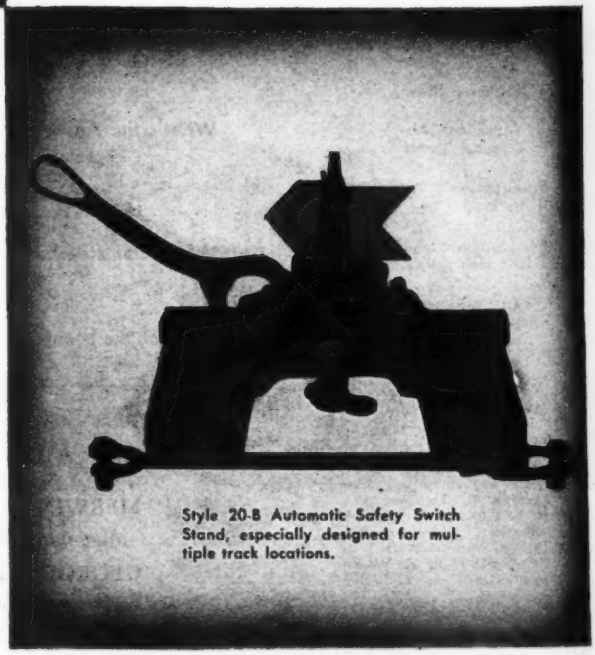

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Railway Engineering and Maintenance

Maintenance—

Is It Keeping Pace With Heavy Demands?

The Class I railways of the United States spent $3,167,766,000 for maintenance of way and structures during the last three war years, an average of $1,055,922,000 a year, and more than during any three consecutive years in their history. These were large expenditures, and stood the fixed properties in good stead, but were they large enough to offset the increased wear and tear of these last three years and to prevent the continued accumulation of deferred maintenance?

The answer to this question can be found only in an analysis of the service demands that have been made on the extensive properties that have had to be maintained with the money thus spent, of the purchasing power of the dollar during these years for the materials and labor required, and of the extent to which, in the light of prevailing shortages in materials, the money was spent for the most essential needs. Giving consideration to these factors, maintenance during the last three years was relatively lean compared with that in the years 1927-1929.

While total expenditures for maintenance of way and structures were approximately $575,000,000 greater, or 22 per cent more, in the three years 1942-1944, than in the three years 1927-1929, it should not be overlooked that wear and tear on the fixed properties, measured by the volume of traffic handled, were substantially more, and that many material replacements were substantially less. In the later period, gross-ton-miles of freight traffic amounted to approximately 1,646,000,000 more, or 43.6 per cent larger, than in the earlier period. Likewise, revenue passenger miles in the more recent period were approximately 135,171,000,000 more, or 140 per cent larger, than in the earlier period. On the other hand, the amount of new rail laid in replacements during the last three years was approximately 2,138,000 gross tons less, or 34.7 per cent smaller than in the earlier period, and the number of crossties installed in replacements was 87,834,000 less, or 38 per cent smaller, facts that are not without significance, in spite of the measures that have been taken to increase the life of both rail and crossties since the earlier period.

Add to these considerations the higher average wage rates of the more recent period, the increased cost of nearly every item of material and equipment, the decreased experience of thousands of employees, the lower efficiency of many gang organizations, and the increased interference of traffic with many maintenance operations, and only then do the larger expenditures for maintenance in recent years stand in their true light—as not only far from liberal, but actually inadequate in many respects.

Faced with these facts, and continuing heavy punishment of their properties by traffic, it is not surprising that the Class I railways of the country, as a whole, plan to spend still larger sums for maintenance of way and structures in 1945, which may reach a total of $1,325,000,000. Whether this will be enough to meet current demands will be determined not so much by the magnitude of the amount itself, but rather by what it will buy in those materials and services which the railways need most, such as rail, ties, ballast, etc.

But whether adequate or inadequate, the expenditure of more than a billion dollars a year places heavy responsibilities on all maintenance of way supervisory officers. And to the extent that the amount to be spent may not prove adequate, these responsibilities are enlarged, to the end that every dollar that is spent will go for those things that will prove most effective in insuring the adequacy and safety of war-time rail transportation.

Gang Organizations—

Flexibility Will Be Essential

DURING the coming months nearly all railroads will be faced with maintenance programs as large as, or larger than, those of last year, while the supply of labor will, undoubtedly, be less than that available a year ago. Obviously, therefore, the completion of these programs will require the most effective utilization of all of the men and machines that can be secured. At the same time, such use of men and machines is certain to be handicapped again this year, by a high rate of labor turnover, and, with gangs fluctuating from 50 to 75 per cent of their rated, or desired, complement of men from day to day, supervisors and foremen will be called upon to exercise unusual judgment to secure maximum efficiency and production. Under such conditions, it will be impossible to adhere strictly to former standard organizations, and many variations and adjustments will be necessary.

As the result of years of development and experience, the larger extra-gang operations on each road have gradually become more or less standardized. In system rail-laying gangs, for example, a certain number of men and machines have been set up and operations of the various groups of men have been worked out so that all machines will be kept busy and all phases of the work will progress at the same rate, thus avoiding interference and delays. With such an organization, the loss of a large proportion of men from day to day throws a heavy burden on the foreman. He must, frequently at moment's notice, revamp his organization to keep all machines as busy as possible and to re-balance the groups doing various phases of the work.

Such organization adjustments would not be so difficult if the gangs were composed entirely of veteran laborers, but today nearly all extra-gangs contain a large percentage of transient, or relatively inexperienced, laborers, who may be familiar with only the one operation that has been assigned to them. Where this is the case, a shift of men to other work may slow down production and require unusual watchfulness on the part of the foreman or assistant foremen to be sure that the new men are doing their work properly.

There are several things that can be done to help offset these conditions. In the first place, where necessary, supervision should be increased. This will permit foremen or assistant foremen to give the men better training for their new work, to watch more closely to see that the work is done properly, and to correct promptly any delay or trouble in any part of the organization before the progress of the entire gang has been slowed. Secondly, it is desirable that every extra gang include a considerable number of veteran laborers who are familiar with all of the various operations and who can be shifted as required to maintain a balanced organization. Thirdly, the method of doing the work should be modified somewhat, if circumstances permit. For example, in rail laying work, certain finishing-up operations can be omitted temporarily, to be done by the regular section forces after the prime operations are out of the way. No relaxation in the quality of finished work, however, should be permitted in high-speed main line tracks.

In addition, the gang operations can sometimes be altered slightly and, in some cases, the regular section gangs can be used as a reserve to fill in the extra gangs as needed. On heavy-traffic lines, where the work must be done under traffic, full advantage of the machines must be realized while track occupancy is permitted. At the same time, some of the finishing-up work can often be done by the remainder of the gang, while the machines are being removed or are in the clear for traffic.

Obviously, there is no one solution for the problems that will be encountered, because they will vary on each road, and even in each gang. Under such circumstances, those foremen with the most ingenuity and resourcefulness will get the most work done and, rather than hold them to strict standard organizations, they should be permitted wide flexibility in their organizations to meet conditions as they arise.

Power Machines—

Is Double-Shifting Practicable?

IN view of the immense amount of work required to maintain the fixed properties of the railways under present traffic and operating demands, and of the difficulties that face the maintenance forces in their efforts to do the work that needs to be done, it is not surprising that the suggestion has come from some quarters that power machines, such as cranes, power shovels, draglines, tractors with bulldozers or excavating and loading auxiliaries, tie tampers, welding equipment and other types of machines employed in maintenance of way tasks, be double-shifted in an effort to increase the output of the machines.

Obviously, if it is practicable to double-shift any or all of these machines it will be desirable to do so, for word comes from all parts of the country that the amount of work that is being accomplished by the maintenance-of-way forces is falling short of the needs of the present situation. Information also indicates that in relatively few cases is the double-shifting of such equipment being practiced. If, therefore, by double-shifting these machines, enough more work can be performed to warrant the effort, maintenance-of-way officers who fail to do so are not living up to their opportunities.

In cases of emergency, roadway machines should be worked continuously until the emergency is past and traffic is restored. On the other hand, routine operations should be confined to the daylight hours, particularly where on-track machines are employed or the track must be obstructed; otherwise hazards are introduced that cannot be avoided, while the effectiveness of the gang will be impaired. At no time, except during the last half of June, until high latitudes are reached, is there enough daylight to permit two 8-hr. daylight-shifts to be worked. Furthermore, it is rarely possible to double-shift any of these machines regularly, because there is not enough labor to man the extra shifts.

Again, to perform many classes of work—and these include the jobs that are most essential if traffic is to be kept moving, such as laying rail, ballasting, other surfacing and renewing ties, the gang must be strung out, in some cases for almost a mile, and progress at a more or less rapid rate. In such cases, to permit night work, an unduly large lighting plant, completely mobile, would need to be provided.

When it comes to off-track equipment, the situation is somewhat different, for much of this equipment, such as power shovels, draglines, cranes and tractors with auxiliary equipment, may be expected to work within somewhat circumscribed limits, so that the lighting of the work presents no special difficulties. If, however, the jobs upon which they are to be employed are small, with frequent moves necessary, more of the foregoing objections will apply, although the classes of work to which they are likely to be assigned will seldom create any hazards to trains.

Another factor that is of some importance at this time is the shortage of experienced machine operators. Not a few operators now employed, who are doing a fairly satisfactory job during daylight, would become a serious menace to the safety of the men in the gang and to their machines, if assigned to other shifts. Again, when an operator is assigned regularly to a machine, it becomes his machine, and, as such, he accepts responsibility for it and takes a personal interest in keeping it in good operating condition. On the other hand, it is the almost universal experience, even in normal times, that where such machines are double-shifted, their condition deteriorates, because neither operator takes the trouble to make needed repairs nor adjustments. This situation becomes more aggravated as the ability of the operator decreases and as the machine increases in age and thereby becomes less efficient.

Taken altogether, there are not only serious objections, but equally serious obstacles to the double-shifting of most roadway machines in use today, despite the crying need for increased output. Most maintenance officers who have studied the subject, and particularly those who have endeavored to work their machines in double shifts, are convinced that more and better work can be accomplished by working a single shift of 10 or 11 hours a day, rather than to work two shorter shifts, and this has become a widespread practice.

New Ideas—

Must Come Largely from the Ranks

RAILWAY maintenance men are generally agreed that the methods and practices employed in their departments must be in a constant state of improvement toward the goal of increased efficiency and economy. It is easy to make such a statement, and to agree that it is correct, but it is another matter to put the thought into action, that is, to initiate ideas and suggestions for effecting the necessary improvements. It is, therefore, pertinent to raise the question: How can maintenance of way officers be sure that the necessary ideas for improving their operations will be forthcoming?

In the first place, it is taken for granted that one of the responsibilities of supervisory officers is to originate innovations and improvements themselves, but it would be a mistake to assume that such officers are the only persons qualified to initiate ideas and suggestions for improving efficiency. Very often, these men, being more concerned with matters of broad policy, are more or less out of touch with the details of the work, with the result that necessary or possible improvements frequently escape their attention simply because they are not in a position to see or recognize the need for them.

The rank and file of employees, on the other hand, being in intimate contact with the details of methods and practices, are in a more advantageous position to recognize their deficiencies and possible ways of improving them, especially if such employees are alert to the need for increased efficiency. Hence, if advantage is to be taken of every possible source of suggestions for improving the quality and quantity of the work performed, it is necessary, first, that all employees be kept alert to the constant need for improvements, and second, that channels be established through which acceptable ideas originating in the ranks can be brought to light and given proper consideration. All too frequently, such channels are completely lacking.

For instance, a track laborer may be hesitant to put forward an idea occurring to him because of the fear that, instead of the foreman or supervisor giving impartial consideration to the suggestion, his reaction may be one of ridicule, or of seeking to develop arguments against introducing the improvements, or, at the most, of grudging acceptance. Furthermore, rank-and-file employees may not constitute a fruitful source of suggestions for improvements because they have not been impressed with the need for them and are not on the alert to detect such possibilities. Finally, in the absence of machinery for insuring proper credit, incentive may be lacking on the part of employees to develop ideas or to put them forward after they have been conceived.

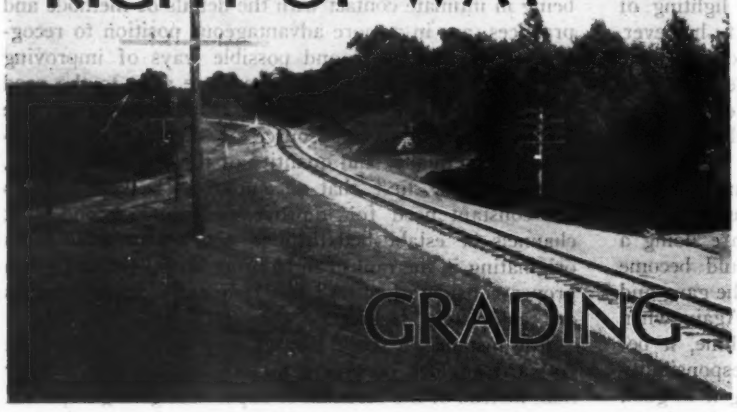
What then can be done to insure a continuing flow of suggestions for improvements in methods and practices? First, such suggestions must be actively solicited and steps must be taken to establish the thought in the minds of all employees that new ideas are welcome. Second, every member of the supervisory organization, from the foremen upward, should be instructed to adopt a receptive attitude when an employee comes forward with a suggestion. Third, no stone must be left unturned to make it clear to all employees that ideas put forward by them will receive thorough consideration and that, if they are adopted and put into effect, proper credit will be forthcoming.

To insure that all ideas will receive proper consideration, it is desirable that a standardized method of presenting them be adopted. Perhaps this requirement can be satisfied by the use of a standard form on which the essential features of the idea, and its advantages, can be presented in a concise manner. For giving consideration to ideas put forward on the standard form, a committee of supervisory officers should be established. Finally, some means of extending credit for ideas that are accepted should be placed in effect. On some roads this is done by means of cash awards, while on others the practice is to reward employees with appropriate certificates of merit.

In the final analysis, the details of the system established to insure the initiation and proper consideration of ideas for improvements are not important so long as they are effective. The important thing is that such a system be placed in effect, to the end that fertile soil will be created in which the new ideas that are so necessary to the continued advancement of maintenance of way methods and practices can grow and gain acceptance.

RIGHT-OF-WAY GRADING

A Proved



Right-of-Way Grading Improves Appearance, to Be Sure, But to Roadway Maintenance Men It Has Many Other Important Advantages

THE TERM "right-of-way grading" indicates correctly the action involved in a large amount of work that has been carried out by a number of railways during the last few years, but it is entirely inadequate to define, let alone describe, the purposes and the results of this work.

No maintenance officer is interested in right-of-way grading as such—the plowing up and redistribution of earth, or the toying with the wide variety of interesting earth-moving equipment that is available today—for any purpose other than to secure tangible, beneficial results; and appearance, important as it may be in some instances, is the least important of these results. Right-of-way grading to the maintenance of way officer means the reshaping of the surface of the right of way to the contour that he wants, to accomplish any one or more of a number of imporant benefits—all in the interest of a higher standard of roadbed and track maintenance, with lower maintenance costs and reduced man-power requirements.

Without any intention of listing the benefits of such grading in the order of their importance, these include improved drainage, the elimination of water-holding pockets, the flattening of continuously sluffing cut faces, the restoration of eroded, weakened embankments, the elimination of conditions conducive to the formation of snow blockades, the widening of the range of vision at grade crossings, and the bringing about of conditions that will permit the general use of power machines in the economical control of objectionable weed growth. In fact, the benefits of right-of-way grading may well include also the widening of roadbed embankments that were never adequate to carry present-day traffic, and, under some conditions, the widening of these embankments on one side to provide a continuous roadway for the movement of company-operated automobile work trucks, or for the general operation of off-track roadway machines, entirely independent of traffic.

It is too well known to be elaborated here that most railroad right of

Above—Bulldozers, Strengthening a Narrow, Eroded Embankment With Readily Available Material From a Nearby Cut. Right—An Elevating Grader, Building Back a Section of Roadbed Shoulder From Surplus Material Directly Alongside

Need of the Future

This article describes a relatively new scope of work being carried out by a number of roads to overcome the shortcomings in early railroad construction and subsequent neglect, resulting in poor drainage, unstable track, constantly eroding slopes, poor vision at grade crossings, pockets for drifting snow, and costly, if not impossible, conditions for the adequate control of vegetation. It describes and illustrates the equipment and methods being used and some of the results that are being accomplished

way, regardless of its width, is in much the same state as when the railroads were constructed; that in most cases, in the interest of rapid, low-cost construction, cut and embankment sections were held to a minimum, right-of-way borrow pits were the rule for obtaining fill material, and ditches, if provided at all, were scooped out close to the track where they might be cleaned out or otherwise maintained by the generally inadequate equipment of the day. While these factors of construction were conducive of construction records for the builders, and in many instances may have been necessary or justified at the time, they have been a constant source of trouble and expense to the subsequent generations of railroad men who have had the responsibility of maintaining these lines of road.

To a large extent over the years, repeated ditch cleaning has been accepted as a necessary element of roadway maintenance. Some cut widening and bank sloping has been done to reduce sluffing and ditch fouling, but, in general, hampered by the costs involved and the lack of suitable equipment to do the work expeditiously and economically, most maintenance officers had come to accept the narrow cut and the close side ditch as inevitable. Furthermore, low-lying adjacent borrow pits, though often grown over with vegetation and, in themselves, innocuous in appearance, had long been put out of mind, although they might stand full of water in even normally dry periods. However, more recently, this attitude of acquiescence in or indifference to such unfavorable conditions has been changing.

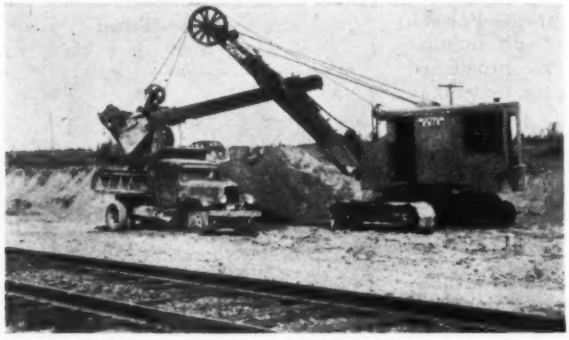
Water has always been considered the Number One enemy of the track structure, and millions of dollars have been expended in pipe drainage and other means to conduct water out of and away from the roadbed. But recently, born largely of the growing development in and availability of suitable off-track grading equipment, there has been increased recognition of the fact that it is not enough to dry up the immediate roadbed—in fact, that it may well be impossible to dry up the immediate roadbed when the adjacent ditches and the condition of the adjacent right of way are such as to keep the roadbed foundation in a constantly saturated condition. For the first time, many roadway maintenance officers have so broadened their vision as to observe that many ditches, existing borrow pits and pot holes, and the general slope of the right of way, are functioning more effectively to draw water toward the track, keeping the roadbed saturated, than they are in draining water away from the roadbed.

As a result of these observations, these officers have decreed that conditions must be changed—that, to the extent possible, cuts must be widened or eliminated, that borrow pits and pot holes must be leveled or filled, that ditches must be placed as far from the track as possible, and that the general slope of the right of way, wherever practicable, must be away from the track, rather than toward it. Combined with achieving these desirable features, they see in many instances also an opportunity, at no added cost, of restoring weathered or eroded track embankments and, frequently, of widening these embankments to the point where they not only have greatly increased stability under the heavier pounding

Right—A Dragline and a Tractor-Shovel Engaged in Embankment Strengthening Work. Below—Tractors and Self-Loading Scrapers, Widening and Reshaping a Cut to Improve Drainage and Eliminate a Snow Pocket

action of present-day traffic, but where they will provide a shoulder over which men, equipment and materials can be trucked directly to the site of work, independently of the track, and also afford a working and maneuvering space for all types of roadway machines, where they will not interfere with the movement of traffic.

As a result of these considerations, and stimulated by the development of suitable equipment and the availability of necessary funds, right-of-way grading has had an enlarging place in the roadway maintenance programs of a number of roads during the last few years, and, to the extent that funds are available, promises to assume a sizeable place in the roadway maintenance programs of these and other roads in the years immediately ahead. Until this type of work is done over thousands of miles of roadway where its benefits are unquestioned, the roadway maintenance forces will be plagued with the problems of much unnecessary unstable track, not to mention the other recurring work which could be avoided, along with the recurring expense involved.



Power Shovels and Dump Trucks Have an Important Place in Right-of-Way Work, Especially Where Long Hauls Are Involved

Wide Variety of Equipment Used

Right-of-way grading, as already carried out and contemplated, involves primarily a redistribution of the material already within the confines of the right of way. Cut slopes are cut back and flattened or benched, and the material is hauled or pushed out to restore, buttress or widen embankments, to fill borrow pits or low spots, or to slope the entire right of way generally away from the track. In this work also, ditches are frequently moved as far from the track as possible, are given the proper pitch to water outlets, and are provided with non-eroding side slopes. Furthermore, high spots and ridges are leveled off, sags are filled in, and any ground obstructing vision at grade crossings or at other points of hazard is cut back and moved to points where it will become an asset rather than a liability. In many cases where excess excavation has been involved, the owners of adjacent land have been glad to give permission to have this material used to fill low spots adjacent to the right of way, and the work has been done with little or no added expense to the railroads.

For all of this work, the railways are taking advantage of the large variety of off-track grading equipment that has become available in recent years, including tractor bulldozers and angledozers, self-loading and self-unloading carryalls or carrying-type scrapers, elevating graders, draglines and dragline-equipped cranes, front-end loaders and excavators, crawler-mounted shovels, automobile trucks, and blade scrapers for finishing-up work. In some cases also, Jordon spreaders have been used effectively in conjunction with bulldozers, the bulldozers pushing the cut material laterally toward the track and the spreaders plowing it forward and out onto the fill slopes.

With this equipment, in a wide range of models and capacities, thousands of yards of material are moved as quickly and efficiently as it was possible to move hundreds of yards with earlier types of equipment, and usually at only a fraction of the cost per yard. In fact, this earlier equipment, including essentially dirt wagons, fresnos and slips, all team-drawn, are a thing of the past on all sizeable grading jobs today, except possibly for minor auxiliary operations or for final smoothing-up work.

One of the factors most favorable to doing this class of work, especially under present conditions, is the large amount that can be done with so little equipment and manpower. Another factor is that it can be done by either contract or company forces as seems most desirable, and requires the use of no critical materials. Still another factor is that it can be carried out at widely separated points at the same time, as conditions may dictate, and frequently can keep busy during the winter months equipment which would otherwise be idle. In fact, some roads have set out single grading units, or pairs of units, together with a boarding car, at sites to be worked, and, except for checking daily reports of the yardage moved and the condition of the equipment, have paid little attention to the operations until completed. At other points, a wide variety of equipment has been massed, either because of the scope of the work or the desirability of completing it quickly.

The accompanying photographs tell better than words of the types of equipment being used, how they are being used, and the results that are being accomplished. In some cases it is largely a matter of loading, hauling and unloading; in others, it is a matter of pushing down, along or up the material to be redistributed; in still others it is one of straight bucket excavation, swing and dump; and in still others it is essentially a matter of leveling-

(Continued on page 383)

A Ditcher-Spreader, Widening and Deepening a Side Ditch, the Material From Which Is Being Used to Strengthen the Adjacent Fill

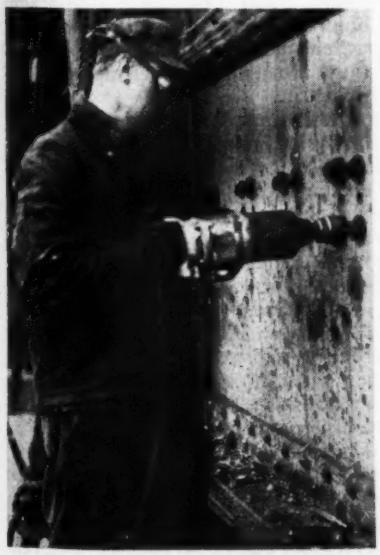
Examples Prove Worth of Mechanizing B. & B. Gangs

By W. F. MARTENS
General Foreman, B. & B. and W.S. Dept.
Atchison, Topeka & Santa Fe
San Bernardino, Cal.

THE shortage of man-power, no doubt, is the most serious and perplexing problem confronting the railroads today. This problem, undoubtedly, will become even more acute before the pendulum swings the other way; hence, other means must be found to obtain the desired results. Since most people are intrigued by mechanical devices, it follows naturally that most workmen should take readily to power tools. Experience indicates clearly that the use of power equipment makes possible longer and more productive working hours, with less fatigue on the part of the user, and spurs men on to greater useful effort. It is obvious, therefore, that the only alternative is maximum utilization of power machinery, if we are to cope successfully with the manpower shortage.

Much research and development work has been done by manufacturers on power machinery and great progress has been made toward the improvement of earlier models and in the development of entirely new units. As a result, power machinery is available today for handling practically every phase of bridge and building work, economically and expeditiously. Realizing that many

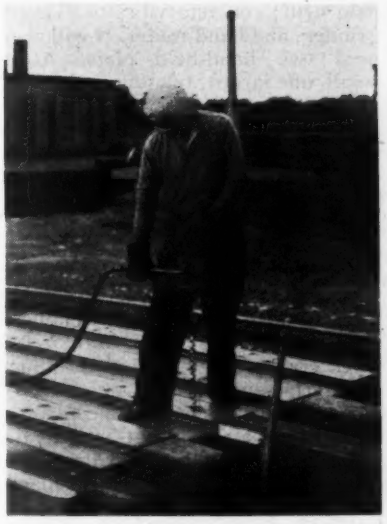
In the March issue was presented a symposium dealing with the question: Should bridge and building gangs be equipped with power tools and machines? Supplementing the three discussions in the symposium, the accompanying article by Mr. Martens is presented, which is composed to a considerable extent of specific examples citing the effectiveness of power tools and machines for different types of bridge and building work



The Impact Wrench Is Also Popular

supervisors at outlying points do not always have access to information that will acquaint them with all of the items now on the market, the following list is offered as information:

Crawler shovels and cranes, truck cranes and shovels, bulldozers, angle-dozers, cow dozers, concrete mixers, flat-bed auto trucks, dump-body auto trucks, earth augers, air compressors, jetting pumps, self-priming pumps, gas-operated electric generating plants, gas-driven friction drum hoists, air-operated hoists, chain saws, safety saws, table saws, scroll saws, radial saws, band saws, jointers, table shapers, table routers, table boring and mortising machines, pedestal type sanders, disk sanders,



Pneumatic Wood Boring Machines Are Proving Highly Useful

belt sanders, bench sanders, pedestal-type grinders, bench-type grinders, hand-held grinders and brushes, screw drivers, power planes, power door mortisers, pedestal-type drills, hand-held drills, concrete troweling machines, reversible impact wrenches, reversible wood borers, drift-bolt drivers, pavement breakers, rock drills, concrete vibrators, riveting hammers, rivet cutting guns, jam riveters, chipping hammers, backfill tampers, scaling hammers and diggers.

What Gangs Should Have

The writer has used power equipment for the last 20 years and has learned that a bridge gang, handling the average run of bridge work, should have as regular equipment not less than one gasoline-driven, 60-cu. ft. portable air compressor (mounted on two pneumatic-tired wheels); two reversible wood borers; two reversible impact wrenches; two diggers; two backfill tampers; one circular safety saw; on chain saw; one hand grinder and brush; one heavy-duty pavement breaker with moil points, chisel digger, tamping pad, etc.; a rock drill (jackhammer), with drill rods and detachable bits; one chipping ham-

mer; one scaling hammer—all of the foregoing pneumatically operated—and a gasoline-engine-driven, self-priming pump with 1½-in. suction and discharge.

The average building gang will need one each of the following electrically-operated tools: Radial saw with cut, rip and combination saws, dado and other cutting heads; jointer; band saw; door mortiser; disk sander; circular safety saw; hand-held drill; concrete vibrator; bench grinder; and hand router. It will also need two hand-held planes (one small, one large), two screw drivers, and two circular safety saws. In addition, each gang in territories where electric power is not available should have a gasoline-powered electric generating plant of the proper size.

Terminal or shop gangs should be equipped in a manner commensurate with the type and scope of the work to be handled. The larger machines, such as crawler shovels, bulldozers, truck cranes, large-size self-priming dewatering pumps, etc., are, for obvious reasons, not adaptable for assignment on a permanent basis to all gangs, but should be pooled and assigned to projects of sufficient magnitude to justify their use. On the other hand, the small power tools that are used more or less regularly should be assigned permanently to individual gangs, and under no circumstances should they be pooled, for too much time is lost in shipping them back and forth. Also, it is a fact that workmen take more interest in and greater care of tools provided for their exclusive use.

Machines Speed Chord Renewal

Using two locomotive cranes, a 60-cu. ft. portable air compressor, one reversible pneumatic wood borer and one reversible pneumatic impact wrench, a foreman, ten bridgemen, a train conductor and two brakemen, renewed the chords (of five stringers each) in a 70-ft. open-deck pile trestle located on a fast section of single track handling extremely heavy traffic. The work was accomplished in 1 hr., 5 min., without even so much as slowing up a single train. The new chords were assembled and were fully bolted previously at a suitable location alongside the structure. The line bolts on one side of the bridge deck were removed, the old chord was taken out, and the new chord was placed. The deck line bolts were then applied. The other chord was replaced in a similar manner. The old chords were loaded and taken to a siding on two flat cars, and were there dismantled.

It would have taken the same gang several days to have done this work without the benefit of the power equipment used. In addition, a restricted speed order affecting no less than 156 trains would have been necessary, and many of these trains would have been flagged and brought to a stop.

Speeds Other Jobs

In another case, a 4-ft. by 4-ft. creosoted-wood box culvert, weighing approximately nine tons, was installed in three hours. The culvert was constructed near the site of the project and was subsequently put in place by a locomotive crane. The same machine was used for excavating and backfilling, as well as for removing the old structure, located some distance away. The latter operation required another three hours. This entire job was handled in two 8-hr. days. No falsework or speed restrictions were necessary. The same job performed by hand methods would have required the services of this crew for nine 8-hr. days; in addition to which it would have entailed substantial temporary track supports and the imposition of speed restrictions.

The Pile Driver Is Considered a Standard Piece of Equipment

Another Example

In still another instance, in record time, a gang consisting of only one foreman, five bridgemen and a pile-driver engineer and fireman, constructed a 32-span pile trestle, with bents on a 45-deg. skew, for a second main track across a dry creek bed. The piles had to be driven into soil that was not too favorable. The equipment consisted of a self-propelled, on-track pile driver; one 60-cu. ft. portable air compressor; one pneumatic, reversible impact wrench; one reversible, multi-vane woor borer; and a small crawler tractor. The latter machine was employed to drag the piles, caps, stringers and ties from the site of unloading, some distance away, to the site of the work during the time piles were being driven, thus avoiding the use of the pile-driving equipment for this purpose. The structure was completed in the same length of time as it would usually require a standard gang of a foreman and ten men, plus the pile-driver engineer and fireman, working without the use of the pneumatic power tools and caterpillar tractor. These are only a few of the many cases that could be cited to prove the value of power tools as a means of offsetting the present labor shortage.

Some Tools Stand Out

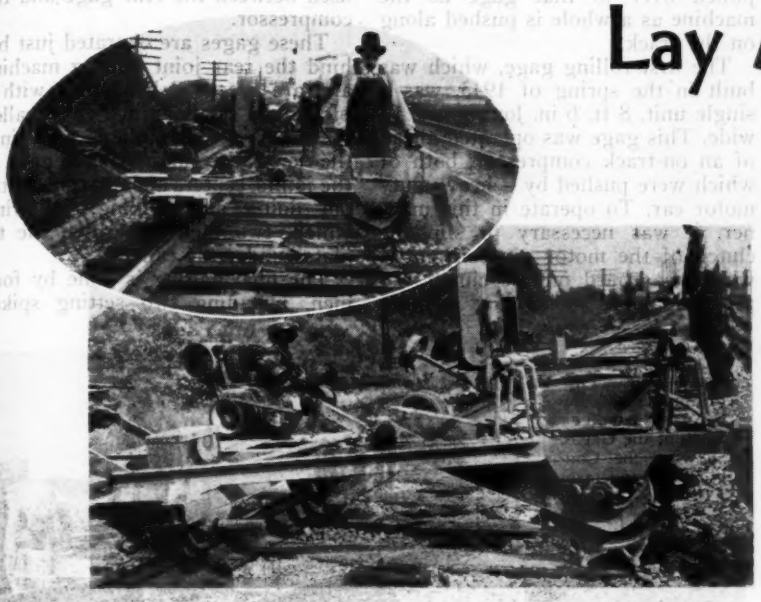
While many types of power tools are essential to attain maximum results, the pneumatic impact wrench and wood borer, perhaps, stand out in front. Each will do as much work as ten hand-operated tools, and will do better work with less effort on the part of the user. The impact wrench is a tool that converts torque from a motor into rotary impacts, enabling the operator, without jolt or shock to himself, to tighten nuts or drive lag screws to any desired degree, or remove frozen nuts that would otherwise have to be cut or burned off.

Gasoline-driven, self-priming pumps, in most cases weighing less than hand-operated diaphragm pumps, will handle many times more water and require no operators; and they are as easily set up as hand pumps.

Radial saws have gained in popularity in the last few years; they can be used for cross cutting, bevel cross cutting, mitering, compound mitering, ripping, bevel ripping and, by using proper cutters, for ploughing, blind ploughing, bevel rabbeting, band rabbeting, dadoing, parallel angle dadoing, blind grooving, radius cutting, tenoning, fluting, routing and rafter-heel cutting. This rig can be had in several sizes and mountings. The radial timber cutter will cross cut timbers as large as 17 in. by 24 in.

All of the equipment enumerated will do quality work, but we must bear in mind that its accuracy and efficiency can be no greater than that of the operators.

New Machines Help Small Gang Lay More Rail



In oval—The Ballast-Cribbing Machine in Operation. Lower Left—Close-up View of This Machine

Two home-made machines—a ballast-cribber and a rolling gage—have been developed and used for some time on the Alton to help offset a shortage in man-power and to improve the quality of rail laying work. The ballast-cribbing machine is used to lower the ballast between the ties, directly at the rail seat, ahead of the tie adzing machines, and two of the rolling gages are used to gage the rail while the spikes are being set and driven. These machines were constructed largely of scrap or second-hand parts and materials and are the result of several years of experimentation

IN 1944, when the Alton relaid 49.1 miles of main-line track with new 112-lb. rail, much of the work was done by a fully-mechanized rail laying gang equipped with two new types of machines—a home-made tie-cribbing machine and two home-made rolling gages. These machines were designed and constructed largely from scrap and second-hand parts and materials, by the general foreman in charge of the rail gang.

A considerable portion of the rail laying work of this gang during the 1944 season was done near Chicago and Joliet, Ill., where the man-power shortage has been especially severe. In the face of this shortage, the new machines have proved of great help in maintaining output, and the rolling gages were particularly helpful in achieving a high quality of output, even though a considerable portion of the labor available was relatively inexperienced and remained so because of a high rate of turnover.

Although the gang using these machines had a normal complement of 45 men, including the general foreman and three assistant foremen, the force at times dropped to as low as 27 men, including the foremen. Despite this, production reached as high as 188 ft. of rail per man per 11-hr. day and averaged approximately 150 ft. per man per 11-hr. day. To the new tie-cribbing and gaging machines, along with the other work equipment used, are given much of the credit for the volume of production, as well as for the quality of the work done.

Cribbing Machine

The first model of the ballast-cribbing machine was developed in the fall of 1940. Since then two other models, incorporating improvements, have been constructed, and a fourth model is now being built, using a frame similar to that of an adzing machine, which will be somewhat lighter in weight and easier to handle.

In general design, this machine is very much like the adzing machine, with the principal exception that the working end has an entirely different type of head, mounted vertically, which is called a "cribbing" wheel. This wheel is of heavy steel construction, 20 in. in diameter, and operates in a plane transverse to the track, parallel with the longitudinal axis of the crossties. The outstanding feature of this wheel is that it has a series of 10 heavy alloy steel blades projecting 3¼ in. from its outer circumference.

The machine is powered by a 6-hp., Model ZZ, Briggs & Stratton 4-cycle gasoline engine, and is driven by a combination belt and chain drive. A belt from the engine drives an intermediate shaft and is equipped with an idler pulley for disengaging the engine. The intermediate shaft, in turn, drives the cribbing wheel by means of sprockets and an enclosed chain. This arrangement also provides for a reduction of engine speed to about 700 r.p.m., which is very important.

Used Scrap Materials

With the exception of the engine and the idler pulley, the cribbing machine was constructed almost entirely of second-hand and scrap materials. The frame was constructed from scrap steel channels (old brake rigging), which were welded together. The belt pulley was secured from the head of an adzing machine. The cribbing wheel was adapted from an old Caterpillar tractor tread-driving wheel, by cutting away the braces between the cogs with a torch, leaving the cogs to form the blades. The cogs were further built up by welding to extend out about ½-in. more. The cribbing wheel is mounted on a motor car axle, cut

to proper length, which, in turn, is mounted on motor car bearings. In fact, the machine as a whole has eight roller bearings, all of which were secured from old motor cars.

The cribbing machine travels along on one rail and is operated by one man, who stands near the wheel end and lifts the counterweighted head from crib to crib. The machine is used immediately ahead of the tie adzing machines and lowers the ballast in the cribs between the ties to a point where it will not foul the adzer bits. This operation was formerly performed by several men with shovels or specially shaped ballast forks.

In its operation, the cribbing wheel is lowered to the ballast between the ties and the heavy blades on its outer circumference knock the ballast outward against a concave steel baffle plate or shield, which has heavy rubber flaps on its bottom edge. After striking the shield, the ballast drops onto the ballast shoulder near the ends of the ties. In this manner, a concave section is dug in the ballast cribs between the ties, directly opposite the rail seat, to any depth which may be required to clear the adzing machine bits. In rock ballast the machine can keep up with a gang laying a mile of rail in six hours, and in lighter or smaller types of ballast it can make still better speed.

The speed at which the cribbing wheel turns is important. If operated at too high a speed, the blades of the wheel cause the rock particles to be thrown against the shield with sufficient force to carom in all directions or to pass under the rubber shield at considerable speed. The blades of the wheel become worn with use and must be built up about ¼ in. for every 10 miles of track cribbed.

The Gaging Machine

The gaging machine or rolling gage has a rectangular steel frame which travels on top of the track rails on four horizontal steel rollers, and two such units, connected by a special coupler, are usually used together. The gaging effect of these units is accomplished mechanically by two adjustable vertical rollers at each corner of the gage, which bear against the opposite sides of the rail head. These are held in position and are adjusted by means of steel set screws, equipped with lock nuts. The gage rollers are also equipped with clamp locks, which operate like those employed on dump car doors and thus allow them to be quickly released for any obstruction on the side of the rail head, such as rail bonds, and to be quickly locked back in position. When the vertical rollers are set to produce exact gage, the new rail, together with its double-shoulder tie plates, is pushed or pulled over to that gage as the machine as a whole is pushed along on the track.

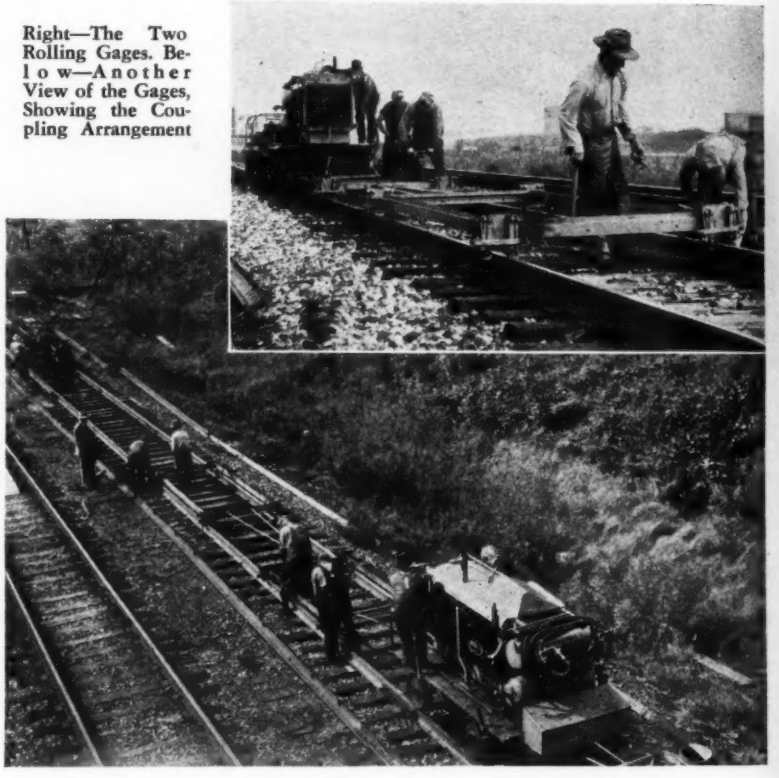
The first rolling gage, which was built in the spring of 1943, was a single unit, 8 ft. 6 in. long and 5 ft. wide. This gage was operated ahead of an on-track compressor, both of which were pushed by a heavy-duty motor car. To operate in this manner, it was necessary to slip the clutch of the motor car constantly, which was hard on the clutch. To provide ample power for pushing two rolling gages slowly at a uniform speed, the compressor was equipped with an old piston-type air motor; a second-hand Plymouth transmission, which was rebuilt with chain sprockets; and a chain drive to the rear axle. This made the compressor self-propelling, with three speeds forward and one backward, and provided ample power to push the gaging units. This change also released a heavy-duty motor car.

When the arrangement for pushing the gages had been worked out, a second rolling gage 13 ft. long was built and this, with the first 8-ft. 6-in. unit, were used in tandem with the long gage ahead for the spike setters and the short one behind for the power spike drivers. The gages were spaced 14 ft. apart by means of a welded, V-shaped pipe coupler, and a similar coupler was used between the rear gage and the compressor.

These gages are operated just behind the rear joint bolting machine and are preceded by a man with a pick and a regular track gage, called the "dummy gage." This man lines the new rail to approximate gage at the joints, centers and quarters, without doing any spiking, following which, two men straighten the tie plates under the rail.

The final gaging is done by four men, including two setting spikes and two driving spikes. The two spike setters work near the head end of the first rolling gage, and are equipped with spike mauls. These men set the spikes by hand at every fourth tie, keeping up with the first gage as it is moved forward. A supply of spikes is carried on the gage frame. The men driving the spikes work near the front end of the second rolling gage, and are equipped with pneumatic spike drivers. These men drive down the pre-set spikes as the second rolling gage is moved ahead, and between spikes they rest their hammers on the gage

(Continued on page 378)



Right—The Two Rolling Gages. Below—Another View of the Gages, Showing the Coupling Arrangement

Rail Damage—Cause and Prevention*

By A. A. MILLER
Chief Engineer Maintenance of Way and Structures
Missouri Pacific, St. Louis, Mo.

Many rail failures that are caused by mishandling can be eliminated by correcting improper practices. This is a responsibility of supervision

Greatest Care Should be Exercised Against Striking the Rail with Spike Mauls

RAIL failures, meaning more particularly rail breakage, may be divided into two general classes—(a) those caused by some defect in the steel itself or in its treatment during manufacture, and (b) those occurring in rail which was perfectly good when it left the mill and which are caused by misuse or mishandling. Examples of the former are the transverse fissures which research has shown to be the result of certain mill practices, now generally thought to be corrected. Examples of the second class are engine wheel burns; rail breakage caused by misdirected blows from spike mauls; unloading rail by methods that tend to damage it; loading rail (either new or relay) for long-distance shipping without giving it the support and anchorage on cars by means that experience has shown will not damage it; burning bolt holes in the rail instead of drilling them; incorrect application of certain types of rail anchors; poor and unskilled butt welding of rail; poor and unskilled building up of rail ends; and other practices that tend to cause damage.

Previously I have mentioned that one of the ways of damaging a first class or good rail is by a misdirected blow from a spike maul; I say misdirected because there is never any occasion when it is permissible to strike a rail directly with any kind of tool, or allow it to receive a heavy blow. Our books of rules have prohibited such mistreatment for more years than we can remember. For similar reasons the use of track punches, once permitted, has long been banned. Rail steel is crystalline and acts somewhat like a rod of glass, that is, it is readily broken after having been nicked. We have known all of this so well and so generally that we may have been negligent in assuming that all of our forces, including the younger generation of trackmen, also have this basic knowledge of the behavior of steel rail. Failure to make sure that the newer men, as well as the more experienced ones, not only know and obey the rules, but the reasons for them, reflects on our supervision.

Some four or five years ago, one of our important railways found a number of its newly-laid 112-lb. rails had cracked webs. These cracks were horizontal and near the center of the web. At the time there seemed to be no explanation for these breaks, although the fact that they all occurred on one side of the track within a comparatively short distance, and that the cracks, or most of them, were at the west quarter point of the rail, seemed to point to some localized cause. However, none was found, and extensive stress measurements also failed to show the cause, or even the probable cause, of the web cracks.

The fact of these failures became known and other roads using the 112-lb. section made investigations to determine whether any similar cracks existed in their rails. A few were found, but on only a few roads. Several other roads having extensive mileages of this section found no failures of that type; but naturally there lurked the suspicion that there might be something wrong with the rail design; if so, then the re-distribution or increasing of the metal in the section (or both) seemed to be a logical thing to do. Some rollings of modified sections, increasing the weight per yard a few pounds, were made and the rail laid.

Failures on New Haven

This was the situation last spring when a series of web failures occurred in rails which had been laid on the New York, New Haven & Hartford during the previous winter. Those failures were examined carefully by Geo. F. Hand of the engineering department of that road. On some of the broken rails, what appeared to be spike-maul dents were found on the webs of the rails on the side opposite the cracks. Etching the rail brought out similar dents opposite the cracks in each cracked rail.

Knowing that the rail had been laid in very cold weather, and remembering that to an appreciable extent rail breakages were associated with cold weather, Mr. Hand caused experiments to be made to determine just

*Abstracted from a paper presented at a recent meeting of the Maintenance of Way Club of Chicago.

how rail acted when struck at low temperature. His results indicated that all of the web failures had actually resulted from spike maul blows when the rail was being laid during the cold weather.

These conclusions were substantiated by tests at Northwestern University made for the Association of American Railroads. In these tests, rails were cooled down to temperatures around zero and then struck sharp blows. It was demonstrated that, at temperatures of 20 deg., F., and lower, web cracks were produced by blows of spike mauls not only in the 112-lb. rail, but just as readily in all of the other rail sections, from 90 to 131 lb.*

This particular case of failures in rail is cited to indicate that when something unwanted occurs, which is seemingly impossible from a design viewpoint, it is well to investigate all elements that might be involved in the design, the manufacture, the transportation, the handling and the application of the rail, to determine the cause and to inform supervisory officers so that undesirable practices can be corrected.

Teaching and Training

Other kinds of rail failures coming out of mishandling of rail have been mentioned. This then brings us to the very essential matter of teaching and training. Generally railroads make use of books of rules, special instructions, information sheets, abbreviated pamphlets of standard designs, etc., to inform and limit those who, because of the distances involved and the absence of direct, quick and personal contact, must often, if not most of the time, obtain their instructions by the written word. This does not give close enough contacts. We, as supervisory officers, have to find the means of teaching and directing by "on the tie" contact.

Many of the engineering publications have splendid articles on maintenance matters that cover suggestions and experiences of seasoned men. Many of these could be lifted, with the permission of the publisher, printed or otherwise reproduced, and sent personally to foremen to be read not only by themselves but by those under them, usually the laborers; they could also be posted in tool houses and outfit cars.

Interest must not only be aroused but it must be sustained; when we as supervision definitely and positively and continually arouse the interest in those we direct in carrying out our purposes, and then sustain that interest by training and telling the "why" for these things, we are going to have few, if any, rail failures as a result of mishandling, mutilating or damaging the rail.

*A detailed description of the Northwestern University tests of the A.A.R. appeared in the December, 1944, issue, page 1135.

Pennsylvania Track Awards

DURING 1944, the Pennsylvania continued its practice of making periodical inspections of its tracks, with special track inspection committees, headed by the chief engineer maintenance of way of each region. As a result of these inspections, the territories of the various supervisors of track were rated at the end of the year for line, surface and general improvement, and letters of commendation were sent by their superior officers to those supervisors whose territories were maintained to the highest degree of excellence.

The names of the supervisors and their assistants (where they have assistants) who received letters are as follows:

New York Zone—New York division—S. M. Rodgers, Trenton, N. J. Long Island railroad—W. L. Steltzer, Jamaica, N. Y.

Eastern Region—Maryland division, main line—G. C. Vaughan, Wilmington, Del., and S. C. Lyons (assistant). Maryland division, branch line—Norman Olsen, York, Pa. Middle division, main line—W. N. Myers, Huntington, Pa., and J. L. Spinelli (assistant). Middle division, branch line—R. H. Joyce, Tyrone, Pa. Philadelphia to Harrisburg, main line—Malcolm Young, Jr., Lancaster, Pa., and M. E. Walker (assistant). Philadelphia division, branch line—J. T. Hartnett, Earnest, Pa. Philadelphia Terminal division—L. W. Green, Philadelphia, Pa. Delmarva division—E. E. Zacharias, Harrington, Del. Williamsport division—C. H. Kooser, Northumberland, Pa.—Wilkes-Barre division—T. F. Scholes, Reading, Pa.

Central Region—Entire region—J. P. McGhee, Coshocton, Ohio. Eastern division—C. P. Sipe, Pittsburgh, Pa. Pittsburgh division, main line—Frank Aikman, Derry, Pa. Conemaugh division—W. J. Gilbert, New Kensington, Pa. Monongahela division—O. L. Fisher, Youngwood, Pa. Buffalo division—A. M. Kennedy, Olean, N. Y. Renovo division—I. S. Pringle, Emporium, Pa. Panhandle division, branch line—L. W. Hogston, Benwood, W. Va. Cleveland division—C. G. Lybarger, Alliance, Ohio.—Erie and Ashtabula division—J. C. Dayton, Sharon, Pa.

Western Region—Chicago Terminal division—W. B. Blix, Colehour, Ind. Fort Wayne division—C. R. Merriman, Warsaw, Ind. St. Louis division—H. J. McNally, Greenville, Ill. Columbus division—J. H. Ault, Dayton, Ohio. Cincinnati division—A. F. Roper, Morrow, Ohio. Logansport division—G. A. Godley, Logansport, Ind. Toledo division—Darel Devore, Marion, Ohio. Grand Rapids division—Harry Hill, Cadillac, Mich. Indianapolis division—J. B. Hill, Indianapolis, Ind.

In addition, the track foremen of each supervisor's subdivision, whose track was maintained to the highest degree of perfection during the year, were commended by the various division superintendents.

New Machines for Rail Laying

(Continued from page 376)

frame. A standard track gage is carried on the compressor and is used every 30 or 40 rail lengths to make sure that the rolling gages are still in correct adjustment.

Like the tie-cribbing machine, the rolling gages were also made of scrap and second-hand parts and material. The frames were made of scrap steel channels, held together with steel corner bracing and end plates, all welded into one unit. For the horizontal supporting rollers and the adjustable vertical rollers, second-hand guides from adzing machines were used.

Although only two rolling gage units were used in this work, three or more can be used with a larger gang, employing more men as spike setters with the front units and four or more pneumatic spike drivers with the rear units. With such an arrangement, every other tie can be spiked to gage, or operations can be speeded up to keep up with the progress of a larger rail gang. Another possibility considered has been the use of three or four of the gaging units with the same size gang to permit spiking up the track in full as the work progresses.

This rail laying work described was done under the general direction of M. D. Carothers, chief engineer of the Alton, and E. M. Unzicker, division engineer at Bloomington, Ill. The tie cribbing machine and rolling gages were designed and constructed by E. M. Thornley, general foreman with supervision over the rail gang.

Maintaining Water Service Facilities—

Power Transmissions and Controls for Pumps

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No. 11 of a Series

In this installment the various methods of transmitting motion from power units to pumps are described in detail, with appropriate mention being made of belt drives and direct drives and the several variations of the latter, including flexible couplings, gears and clutches. Shafts and bearings are also discussed, as are the various types of pump controls. The next installment, to be published in the June issue, will deal with the maintenance of pipe lines

Flexible Shaft and Right-Angle Drive for Deep-Well Turbine Pump

VARIOUS methods are employed in the transmission of power from the power units to pumps used in railway water service. For the sake of convenience they are usually referred to as belt drives and direct drives. A further classification is necessary, however, to cover the application of the various forms of power to the operation of pumps of different kinds and types and the conditions under which they are used, as for example (1) changes in speed from that of the power units to the required pump speed, (2) the transmission of power from a horizontal shaft to a vertical shaft, and (3) the conversion of rotary motion to reciprocating motion. Either a belt drive or a direct drive may include any one or all of these essential features of pump drives.

Belt Drives

Belts, as used in pump drives, are made of many different materials, including leather of several tannages, cotton fabric varying in weave and construction, natural rubber and fabric, synthetic rubber and fabric, balata and fabric, and also a combination of these materials. They are made in flat and V sections, as well as in other sections.

Belt drives are simple and flexible drives, and may be adapted readily to meet the many different requirements of pump operation. With them the speed may be increased or decreased, within reasonable limits, by the use of pulleys or sheaves of the proper size. Where flat belts are used, the power can be readily transmitted from a horizontal shaft to a vertical shaft by the use of a quarter twist in the belt, or the direction of rotation can be reversed by crossing the belt. Another advantage of belt drives is their quiet operation at high speeds, compared with spur-gear transmissions. They also absorb any shock which may be transmitted from the pump to the power unit. The principal disadvantage of belts, particularly flat belts, is that they require considerable floor space in order to obtain the required pulley centers. This objection has been overcome to a large extent by the use of idlers or V-belt drives, which permit of shorter pulley centers. While both the flat type of belt and the V-belt type are used in railway water service, a large majority of the belts that are now employed in this class of service are of the flat type.

The Splice

Although belt drives are comparatively simple, they require intelligent care and maintenance if they are to give good service. The weakest point in any belt is the splice. There are many devices for joining the ends of belts, from leather and wire lacing and the endless belt, to an almost endless variety of metal fastenings.

Much belt trouble can be avoided and the life of belts lengthened materially if proper care and skill are used when cutting and lacing them. A square or straight-edge should always be used when cutting a belt to make a splice to insure that the ends will be square and even. If patented fasteners are used, they should be of the right type and size for the thickness and width of the belt, as well as for the pulley diameters involved. They

should be applied in accordance with the instructions of the maker and in such a manner as to avoid tearing through the holes in the end of the belt or otherwise damaging it. Where wire or rawhide lacing is used, the holes should be as small as consistent with the size of the lacing, and should be made with a belt punch or other tool that will produce a clean hole. Lacing should always be applied parallel with the belt on the pulley

The Water Service Series

The 10 articles in this series, published previously, include the following:

(1) Introduction (April, 1944)
(2) (3) (4) Sources of Supply (May, June & July, 1944)
(5) The Maintenance of Pumps — Reciprocating Pumps (Aug., 1944)
(6) The Maintenance of Pumps — Centrifugal Pumps (Sept., 1944)
(7) The Maintenance of Deep Well Pumps (Oct., 1944)
(8) Miscellaneous Pumps (Dec., 1944)
(9) (10) Power Units (Jan. & Feb., 1945)

side, and should be crossed on the opposite side, or outside of the belt.

Running the hair side of leather belting next to the pulley will add to the life of belts, as the strongest part of the leather is on the flesh side. In this way the strongest part of the belt will be subjected to the least wear; also the hair side adheres better to the pulley as it is smoother, and this will tend to reduce slippage and consequent wear on the belt. When run with the hair side to the pulley, leather belts will drive as much as 30 per cent more than when run with the flesh side to the pulley. The tight or driving side of the belt should be run at the bottom to reduce slippage and for maximum efficiency.

Should Be Loose

Flat belts should be run as loose as possible without slipping. Loose belts will last longer than tight belts and will cause less wear on bearings. Therefore, the tension on the belt should be only enough to transmit the power without slippage. It will be found that the tension on the belt may be decreased as the speed is increased. A belt correctly adjusted for tension will seldom require a dressing to make it pull properly, but if a dressing is used it should be employed sparingly. It is important that both the belt and pulley be kept as clean as possible. Belt dressing should never be applied to rubber fabric belts as it will cause the rubber to deteriorate.

V-Belts

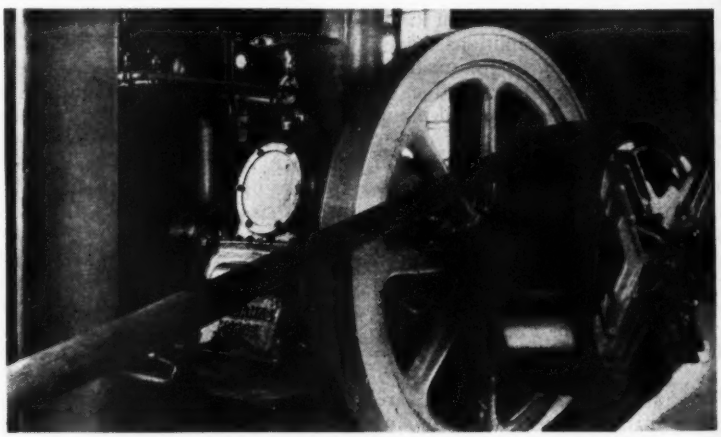
Single and multiple V-belts are used on many pump drives. Unlike the case of the flat belt, short centers are not only desirable but are necessary to the effective operation of a V-belt. Pulley or sheave centers should not exceed three times the sum of the diameters of both of the sheaves, and should not be less than the diameter of the larger sheave. V-belts should be kept fairly tight. Provision is usually made for adjustment of the sheave centers to compensate for stretching. If a V-belt is allowed to become too loose, it will sag and may whip when the power is applied, or when under peak load. This whipping will increase the belt stretch and may cause it to break.

When replacing old V-belts on multiple drives, the entire set should be renewed to insure uniform tension on all units of the set. Under no circumstances should a V-belt be allowed to slip, as slipping will overheat the belt and cause it to wear quickly. Dust, dirt and oil also cause V-belts to slip and wear. Oil should never be allowed to come in contact with rubber V-belts for it will not only cause slippage, but will destroy the rubber. V-belts should not be pried or forced over the edges of the sheaves. More belts are broken, distorted and damaged by this practice than through actual service.

To obtain the maximum service life from any belt it is essential that the pulleys or sheaves be in correct alinement and run true, and that they be kept clean and free from oil and moisture. The belt used should be suitable for the service required of it. The most expensive belt is not always the one that will give the best service under all conditions. A leather belt, when exposed to dampness, will not give as good service as a cheaper canvas or rubber belt.

Direct Drives

The direct-driven pump is a very compact unit, and where the power unit can be connected directly to the pump without the necessity for a change in speed or other power conversion, such as where electric motors are used to drive centrifugal or turbine pumps, it is an ideal arrangement. Unfortunately, such an arrangement is not always possible. In almost every case where other types of pumps and power units are used it is necessary to provide some means of increasing or decreasing the speed of the power unit to conform to that of the pump. Where slow-speed pumps, such as reciprocating power pumps, are used, the speed reduction is usually accomplished by means of reduction gears. These gears may be the conventional pinion and gear type for single or double-reduction, or enclosed gear trains. Various other types of speed transmissions are also available. Where a deep well or other vertical turbine or centrifugal pump is driven by an internal combustion engine or other direct-connected power unit having a horizontal shaft, a right-angle drive is used, the power being transmitted through bevel gears instead of spur gears.



Example of Belt Drive With Clutch

Alinement

Maintaining correct alinement is an essential feature in the maintenance of power units and pump transmis-

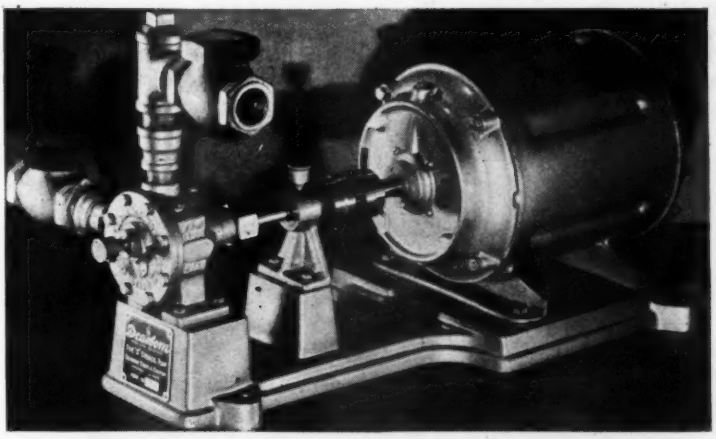
sions. Misalinement is responsible, directly or indirectly, for much of the repairs and replacements required by equipment of this kind. It should not be assumed that good alinement will be maintained automatically once it has been established. If this were the case, rigid couplings could be used instead of flexible couplings, which are considered essential to almost every installation. Settling or shifting of foundations and buildings, tension, vibration, wear on bearings, strains because of piping, temperature changes and other conditions, all tend to cause misalinement.

Flexible couplings are used to compensate for slight changes in alinement and end float of the shafts, but they cannot be expected to take care of more severe conditions. Frequent inspection by the water service repairman is necessary to maintain good alinement and to prevent excessive wear on shafts, bearings, gears and other parts. The alinement of couplings can be checked by placing a straight-edge across the rims of the couplings. If in good alinement, the straight-edge will rest evenly on both rims at the top, bottom and the sides. A straight-edge may also be used to check the alinement of spur gears by placing it across all faces of the intermeshing gears. If they are in correct alinement, the straight-edge will touch the gear face at all points. The misalinement of gears is usually due to wear or shifting of bearings. Loose bearings also cause excessive wear and noisy operation of gears. Bevel gears may be lined up by using a square against the face of the gears.

Flexible couplings of many different designs are used. Those in most common use are the pin type and the jaw coupling. In the pin type the pins are fixed in one-half of the coupling and extend into clearance holes in the other, the pins being cushioned in the holes by means of rubber bushings. Another type of pin coupling has pins fixed in both halves of the coupling and fitted through a rubber, leather, or composition disk placed between the two halves of the coupling. Still another has an endless rubber belt interwoven between the pins. Jaw-type couplings are made in various types, all of which are similar to the square jaw clutch. Some of them have a separate flexible member composed of rubber, fiber or other material, which acts somewhat as a cushion.

All flexible couplings will compensate for a certain amount of misalinement, but where this becomes excessive, it must be corrected to insure good operation and to avoid possible damage. If conditions are such that correct alinement cannot be maintained, universal joint couplings or flexible shafts may be used.

Misalinement may be parallel or angular, or a combination of both. Parallel misalinement is usually caused by a settling foundation or shifting bearings, and may be corrected by shimming up the base of the pump, transmission or power unit, or by adjustment of the bearings. Angular misalinement may be caused by unequal settlement of foundations, shifting on foundations, or by pipe pull on the pump or other causes. Foundation bolts should be kept tight to avoid the possibility of the pump or power unit shifting out of line. Loose foundation bolts may also cause excessive wear on bearings, shafts and gears. All piping should be well supported to prevent any strain on the pump that might tend to throw it out of line. Misalinement will be indicated by overheated bearings, excessive wear and loss of power. If good alinement is maintained the units can be turned over by hand with little effort.



Rotary Pump and Enclosed Motor Direct-Connected with Flexible Coupling

Gears

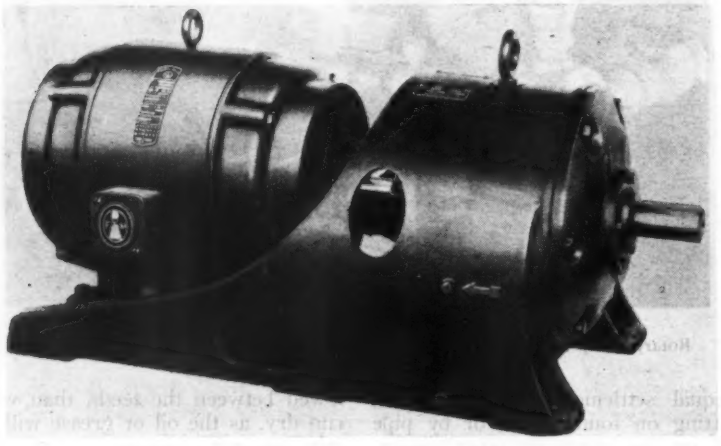
Gears are essential to practically all direct-connected pumping installations where it is necessary to effect changes in speed or to transmit power from a horizontal shaft to a vertical shaft. Spur gears are generally used to transmit power between parallel shafts, and bevel gears when the axes of the shafts intersect at right angles, as when driving deep well turbines by internal combustion engines or by other power units with horizontal shafts.

The life of gears is dependent upon good maintenance and can be greatly extended if they are given the right care. They must be maintained in good alinement to prevent uneven wear of the teeth. Loose, poorly-adjusted bearings will materially shorten the life of gears. Even where the bearings are cast integral with the gear housing the gear may be thrown out of line by worn or loose bearings. In fact, this is the principal cause of excessive gear wear, aside from that caused by grit and dirt. Gears should be kept clean and well lubricated. They may wear more rapidly with lubrication, where grit or dirt is allowed between the teeth, than when run dry, as the oil or grease will retain the grit, forming an abrasive. Enclosed gears are run in a bath of oil or grease and are not subject to dirt or grit. It is important that the correct oil or grease level be maintained in the gear housing and that it be changed at regular intervals. Oil is generally used where the gears are run at high speeds and grease where they are run at lower speeds.

The teeth of the gears should be meshed correctly. When meshed too deeply they will wear rapidly and be subject to breakage from excessive pressure, as well as exert pressure on the bearings. If not meshed deeply enough their strength will be greatly reduced, which, together with the excessive backlash, may cause them to strip themselves under load.

Spur gears are used extensively for duplex and triplex pumps and form a compact and reliable drive. They are used with both single and double-reduction gears. However, they wear rapidly at high speed and become noisy in operation. Rawhide and fibre pinion gears are sometimes used to reduce the wear and the noise of operation. With this type of gear not more than two teeth are in mesh at any one time, the load being transferred rapidly from one tooth to another. Because of this, spur gears are limited to comparatively low speeds. Helical and herringbone gears are also used to some extent in

pump transmissions and are generally quieter in operation. The teeth of helical gears first mesh at one end and gradually roll together, breaking contact at the other end. Herringbone gears are a combination of helical gears with a right and left lead. They are very efficient gears, but must be kept in perfect alinement to avoid throwing the load on one side of the gears. In some cases the pinion is allowed to float on the shaft so that it will follow the main gear. Broken teeth in gears can be replaced by drilling and topping short studs in the gear rim and then shaping them to the face of the teeth, or they can be replaced by welding. Such repairs are more or less temporary, however, and it is advisable to replace the gear as promptly as possible.



Combined Motor and Enclosed Speed-Reduction Gear

Clutches

Clutches are generally used on direct-driven reciprocal power pumps to permit the power unit to attain speed before the load is applied. They are usually of the friction type, although jaw-type clutches are sometimes used where the speed is low. Most of the clutches used are manually operated, although automatic clutches are used to some extent with automatic and remote control, particularly under severe starting conditions. These clutches are usually of the centrifugal type, in which the friction bands expand and exert a frictional drag on the drum as the power unit gains speed. They are also made in coupling types and are equally adapted to direct drive and belt drive. Clutches require little attention if they are well designed and are not abused. Toggles, pins and bands must be maintained in good condition and must operate freely, without lost motion. Friction clutches should not be allowed to slip unnecessarily, as this will cause overheating and possible damage. Care should be exercised in oiling clutches to avoid interference with their operation.

Shafts and Bearings

Transmission shafts range from the shaft of a centrifugal or other rotary motion pump, where the power is applied directly to the impeller or other rotating element, to the crankshaft or a reciprocating-type pump, in which the rotary motion of the shaft is converted to reciprocating motion by means of a crank, connecting rod and crosshead. The principal item in the maintenance of shafts consists of keeping the bearings in good operating condition and the gears, pulleys, fly-wheels, couplings and clutches tight on the shafts. The correct alinement of shafts is also very important in their maintenance, as poor alinement is largely the cause of bent, worn or broken shafts.

The fundamental purpose of a bearing is to support the moving parts. Therefore, the efficiency of the moving parts of any machine is dependent upon the condition of its bearings.

Sleeve-type bearings may be either solid or split. The latter is preferable where the bearing is subject to considerable wear, as this wear can be compensated for by the use of shims between the bearing halves. Solid bearings must be renewed when worn. The condition of bearings should be checked frequently by the water service repairman as a loose or worn bearing will cause loss of power and excessive wear. The bearing should have a snug fit, but should not be tight enough to cause it to heat.

Bearings may be provided with either self-contained oiling systems with oil wells and rings, or they may be grease lubricated. The oil or grease should be free from dirt or other foreign matter, and fresh oil should be applied as often as necessary to insure constant and adequate lubrication.

Bearings should be checked occasionally by the pumper to see that no oil or grease works out along the shaft. Where oil seals are provided, they should be maintained in good condition. Babbitt metal bearings should be rebabbitted when worn, or replaced with new shells when worn to the extent that they cannot be further adjusted. Under no circumstances should babbitt bearings be allowed to run until the shaft rubs against the bearing housing.

When replacing or renewing bearings, the shaft should be placed in good condition. If badly worn or scored, it should be refinished in a lathe if possible. If worn beyond repair, it should be replaced. Both the shaft and bearings should be clean and free from any scoring or friction burns when reassembled after taking them down for repairs or for other reason.

Ball or roller bearings, commonly termed anti-friction bearings, are used extensively where bearings are necessary, and are rapidly coming into more general use, particularly on electric motors and centrifugal pumps. Ball bearings are used to a much greater extent in railway water service than roller bearings.

The first principle of either ball or roller bearing maintenance is cleanliness. One manufacturer estimates that more than 90 per cent of all ball bearing failures are caused by dirt that has found its way into the bearing, largely because of carelessness in handling, either before or during assembly.

Each ball bearing is a complete unit and should not be tampered with. If a failure occurs, the entire unit should be replaced. Never use a hammer directly on the bearing when removing or replacing a ball bearing on a shaft. If possible, use a bearing puller, always exerting the pressure on the inner ring. A drift pipe and hammer may be used if other facilities are not available. Do not put any pressure on the outer ring or housing, as it will damage the bearing.

If it should be necessary to use a drift tool to drive a bearing on or off a shaft, the pressure should be applied evenly around the bearing so that it will move squarely along the shaft. This also applies to the outer race ring. It is seldom necessary to remove the cup from the housing as both cup and housing may be readily inspected with the cup in place.

Grease is used on some bearings and oil on others, depending largely upon the speed at which the bearing is operated. For example, oil is preferable for high speeds, where the churning of grease would create too high an operating temperature.

Good lubrication is essential to the satisfactory operation of ball bearings, but the bearing should not be over-lubricated. This is particularly important where grease is used. As a general rule the oil level should not be above the center of the lowest ball or roller, measured when the bearing is stationary. Where grease is used, the housing of ball bearings should be packed from one-half to two-thirds full of grease. It is impossible to establish a fixed rule as to how often a ball bearing should be oiled or greased, as this can be determined only by observation.

Bearings should be cleaned at regular intervals, usually once a year, and fresh oil or grease applied. Hot kerosene at 110 to 120 deg. F., or carbon tetrachloride, should be used to flush old oil or grease from bearings, and fresh oil should be applied immediately to prevent rusting. In every case the manufacturer's recommendation should be followed as to the grade of oil or grease to be used.

Controls

Automatic and remote control are used extensively in the operation of electrically-driven pumps at railway water stations, and to some extent where internal combustion engines are used. In some cases the hours of operation of a pump are governed by a time clock, to permit its operation only during periods of off-peak load; in this way to obtain a better rate for the electricity used or to keep down the maximum demand charge.

The operation of automatic controls are initiated by means of float switches, pressure switches, electrodes, thermostats, time clocks, or by the flow of water in a pipe line. Float switches and electrodes require a transmission line between the switch located in the tank or reservoir, and the control at the pump. For this reason, this type of control is usually installed at points where the pump is a short distance from the tank. Where trouble is experienced in cold climates by ice interfering with the operation of floats, this is sometimes overcome through the use of electrodes to open and close the electrical circuits controlling the operation of the pump. These are placed at the desired levels and are not subject to interference by the formation of ice, as with floats.

Where the tank is some distance from the pump, pressure switches are used to start and stop the pump. It is difficult to control the water level in the tank within close limits with a pressure switch because of the surges in the pipe line when the flow is started or stopped. Various devices are used to overcome the effects of surges on the operation of pressure controls. A combination pressure switch and time switch is commonly used for this purpose. The pressure switch stops the pump when the tank is filled and the time switch stops or starts it at regular intervals as desired, the intervals being so timed as to permit the surges to subside.

Another type of control is provided with a time delay in the starting circuit, which is designed to prevent the surges in the pipe line from reacting on the pressure switch. This type control also provides protection in the case of deep-well turbines in preventing the power unit from starting against back spin, which is a very important feature.

Thermostats are used only where the question of temperature is involved as, for example, in the case of boiler washing plants. Switches actuated by the flow of water in pipe lines are used chiefly to operate the auxiliary pumps used to feed chemicals at water-treating plants, and in some instances for the operation of booster pumps.

Frequent inspection should be made of automatic control equipment to insure its being in good operating condition at all times. While the maintenance of the electrical equipment is handled by the electrical departments on most railroads, the district water service repairman shares the responsibility of checking the operation of this equipment. The control should be tested occasionally to see that it is in good operating condition. Particular attention should be given to the operation of float switches and other level controls in wooden tanks, as the staves will dry out at the top, permitting them to leak and decay if the correct water level is not maintained.

Pipe lines should be maintained in good condition where pressure control is used. Leaks in a line may create a false condition, resulting in the premature operation of the pump. Large taps off the discharge line will have the same effect and, in addition, may cause surges in the line that will interfere with the operation of the control.

The success of full automatic control is dependent upon keeping the pump primed. This is particularly important in the operation of centrifugal pumps as they will not pick up water unless full primed, and may be damaged if allowed to run dry. Various methods are used in priming pumps under automatic control. In some cases the pump is so located that the water will flow to the pump; in others a by-pass from the discharge to the suction is provided. Where pumps take water under a suction lift, automatic priming is desirable. Foot valves are usually necessary to the automatic operation of these pumps.

Right-of-Way Grading

(Continued from page 372)

up operations. Whatever the operations or equipment involved, the aim is the same—improved drainage away from the track, the avoidance of sluffing cut slopes, the restoration or widening of embankments, the filling of water-retaining pockets, the widening of vision at crossings in the interest of safety, the provision of a shoulder for the operation of off-track work equipment, the simplification of vegetation control through permitting the use of power mowers, and, where a factor, the elimination of conditions conducive to the drifting of snow. To all of these advantages must be added that of improved appearance, with its favorable effect on both the traveling public and employees. Significant of all of these advantages is that they are of a permanent character.

Some of these advantages, it is true, are relatively intangible, and, at most, are difficult of appraisal, but others demonstrate their value almost immediately. One of the latter is the greater stability afforded the track structure, a factor which has had an important influence on the amount of right-of-way grading that has been carried out during the last two or three years when other means of increasing stability, involving the use of critical materials or a larger amount of labor, have been necessarily restricted. Another is the lower cost of weed control, which on some sections graded, through the use of wheeled and tractor-mounted mowers, has been cut to less than one-fifth former costs; and still another of these advantages is the effect on snow-drifting, which has been so pronounced in some cases that it has been possible to eliminate completely the maintenance of former snow fences in the areas involved. In many cases, these advantages alone more than justify the cost of the work, which, depending upon conditions and the type of equipment involved, may range from as little as a few thousand dollars to as much as several thousand dollars per mile.

Defective Switches Cause Two Derailments

TWO recent derailments, both resulting in casualties, were caused by defective switch mechanisms according to the reports on these accidents issued by the Interstate Commerce Commission, which also point out in each case that the accident could have been averted if the switch in question had been equipped with a mechanical locking device, so designed that the points would have been held in the intended position independently of the normal switch operating mechanism. Abstracts of the Commission's reports on the two accidents follow.

Broken Eye Bolt

The first of these derailments was of a freight train on the Louisville & Nashville, on October 9, 1944. The accident occurred at the south switch of an east-side industry track at Laden, Ky., on the Cumberland Valley division, 17.3 mi. north of Lynch, Ky. No. 44, a northward second-class freight train, consisting of Engine 1493 of the 2-8-2 type, 82 cars and a caboose, passed Chad, Ky., 10.8 mi. south of Laden, about 3:50 p.m., and, while moving at an estimated speed of 25 m.p.h., in territory where the maximum authorized speed for freight trains was 25 m.p.h., entered the south switch of the industry track at Laden, overturning the engine and derailing the first 18 cars. The engineman and forward brakeman were killed and the fireman was injured. The weather was clear at the time of the accident, which occurred about 4:20 p.m.

Approaching the switch from the south, the main track was tangent for 1291 ft., followed by a 4-deg. curve to the right, beginning 148 ft. from the switch and extending 412 ft. beyond. The main-track structure consisted of 100-lb. rail, 39 ft. in length, laid on an average of 23 treated ties to the rail length. The track was fully tie-plated, single spiked, provided with four rail anchors per rail, and was ballasted to a depth of 14 in. with crushed limestone.

The switch consisted of two 16.5-ft. points connected by two switch rods, and a No. 10 spring frog, and was operated by a hand-throw, intermediate-type switch stand, located on the east side of the track. The head rod was joined to the switch stand by a connecting rod six feet long. This rod was attached to a threaded eyebolt, 1⅜ in. in diameter and 7 in. long, by means of a turnbuckle, the forks of which were fitted above and below the eyebolt. The connection between the turnbuckle and eyebolt was by means of a one-inch bolt, a nut and a cotter key. The eyebolt engaged an aperture in the spindle attached to the bottom of the switch stand. A nut on the opposite end of the eyebolt was provided to prevent the bolt from becoming loose.

Examination of the track after the derailment revealed that the switch points were set to divert trains to the industry track, but that the operating lever was latched and locked in position for a main track movement, and the green target was displayed for approaching trains. The threaded end of the eyebolt which joined the connecting rod and the spindle was broken, a considerable portion of the fracture having existed for some time. The break, which occurred within the portion of the eyebolt extending into the spindle, could not have been detected by visual inspection unless the eyebolt had first been disconnected.

Marks on the track and on the engine truck wheels indicated that the switch points were midway between open and closed positions as the engine approached the switch, and that the leading truck wheels moved outside their respective switch points a short distance, then forced the left point against the stock rail, diverting the driving wheels to the turnout.

The switch was last inspected by the section foreman about 48 hr. prior to the accident, but no defective condition was observed. The members of a crew of a southward train passing Laden about six hours before the accident were the last persons known to have operated the switch, and at that time the points fitted properly. About 3 hr. and 30 min. prior to the derailment a northward train passed safely over the switch and its crew observed no defective condition.

As a result of its investigation, the Commission found that this accident was caused by a defective switch, remarking that, if the switch had been equipped with a mechanical locking device so designed that the points were held in the intended position independently of the connecting rod, the switch points would have been locked for through movement on the main track after the connection was broken, preventing the accident.

The second of the two accidents involving switches occurred on the Gulf division of the Gulf, Colorado & Santa Fe, on the afternoon of November 17, and involved a mixed train, which, at the time, was traveling at a speed of approximately 25 m.p.h. This accident occurred at Dorman, Tex., in single-track territory, directly over a No. 10 turnout from the main line to a long industry track parallel with the main line.

The switch involved was of 90-lb. track material, and consisted of two 16.5-ft. switch points and a No. 10 spring frog. The switch points were connected by two switch rods and were operated by a hand-throw switchstand of the intermediate type. The head rod of the switch was connected to the switchstand by a connecting rod 6 ft. long, which, in turn, was connected to a single crank at the base of a spindle by means of an eye which fitted over the foot of the crank. An angle-iron guard of ⅜-in. rolled steel, riveted to the base casting of the stand, projected over the eye of the connecting rod and the crank foot to prevent the displacement of the rod.

Defective Features

After the accident, examination of the switchstand disclosed that the switch points were in position for entry into the industry track, whereas the operating lever of the stand was latched and locked in position for movement on the main track. The target was also in position for main-line movement. Examination also showed that the angle-iron guard was broken from the base and that a considerable portion of the fracture of the guard had existed for some time prior to the accident. Marks on the track structure indicated that the switch points were midway between the open and closed positions as the engine approached the switch.

The investigation brought out the fact that the switch was last inspected by the section foreman, and the parts cleaned, six days prior to the accident, and that no defective condition was observed at that time. The local roadmaster also pointed out that the fracture in the angle-iron guard could not have been detected by ordinary inspection so long as the guard remained in place.

As in the case of the accident on the L. & N., referred to earlier, the Commission, in its report, stated that the accident on the G. C. & S. F. could have been averted if the switch had been equipped with a mechanical locking device, so designed that it would hold the points in the intended position.

What's the ANSWER?

Planning Yard Work

Should the section foreman or the supervisor plan the work in a large yard? Why? What qualifications should a yard foreman possess?

Supervisor Should Plan

By F. G. CAMPBELL
Assistant Chief Engineer, Elgin, Joliet & Eastern, Joliet, Ill.

Work in a large yard definitely should be planned by the supervisor or the general foreman, rather than by the section foreman. A section foreman in a large yard will either be assigned to a section which ordinarily comprises only a small part of the total yard area or he will have charge of a gang which may work over the entire yard, but will never have charge of, or a complete perspective of, all of the work that must be done in the yard. The section foreman will never, therefore, be able to determine the order of importance of the work as it is related to the whole yard. Again, he will not be likely to be able to plan his work with the least interference with the operations of the whole yard.

On the other hand, the supervisor, or the general foreman, has a wider perspective and is in a position to view the yard in its entirety and to consider it as a whole. It should be his responsibility, therefore, to see that the work is planned in accordance with the requirements of the yard and its operation, and to issue such instructions to the section foreman as may be necessary to carry out the plans. He should, however, leave to the section foreman the responsibility for directing his gang safely and efficiently in the carrying out of the work assigned to him.

One of the most important qualifications of a yard foreman is his ability to co-operate with and work harmoniously with the employees and supervisory forces of other departments. This applies to a general foreman as well as to a section foreman. A foreman of whatever grade, who cannot work his way through a yard without continually having to request, through the supervisor or roadmaster, the use of tracks, is almost useless in a busy terminal or industrial yard.

Obviously, a yard foreman should also have a special aptitude for renewing turnouts and switch material with the least interference with traffic. On his own initiative he should be able quickly to handle emergencies, such as minor derailments, rail failures, failures of switch materials and other emergencies that require quick action in a busy yard. The duties of a section foreman in a yard differ in important respects from those on a main-track section, for which reason it is not uncommon for a foreman with a good record on the main line to be a failure in a yard and, conversely, for a good yard foreman to be a failure when put out on the main track.

Foreman May Participate

By SUPERVISOR OF TRACK

In a yard that is not large enough to warrant more than one yard gang, the section foreman takes the place of the general foreman. If the yard is of sufficient size to require two or more track gangs, there will also be a general foreman who is, in effect, an assistant supervisor or supervisor.

In the first case, the foreman should have a comprehensive knowledge of the needs of the yard and of the methods best calculated to get his

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Send your answers to any of the questions to the What's the Answer Editor. He will welcome also any questions you wish to have discussed.

To Be Answered in June

1. *What are the most suitable dimensions for the face of a tamping bar for use with tie tampers? For tamping blades? Why? Does the kind of ballast or the amount of the raise make any difference? If so, what?*

2. *Is it desirable to paint the interior wall surfaces of enginehouses and shops white? Why? How can this be done? How can they be kept white?*

3. *Can ties be tamped too solidly? Joint ties? Why? How? Does the density of traffic or the speed of trains make any difference?*

4. *Should creosoted piles be allowed to cure after treatment? Why? How long?*

5. *What preparatory work should be done in advance of laying rail? How far in advance? Who should do it? Does this differ for single and multiple track? Why?*

6. *What facilities should be provided for the delivery of water to Diesel locomotives? Where should they be located? What considerations are involved?*

7. *Is it permissible to send out a flagman, with instructions to return at a given time or after the passage of a certain train? Why? If not, how should he be recalled? What precautions should be observed?*

8. *Is there any advantage in painting the interior surfaces of galvanized gutters with asphalt or coal-tar paints? Any disadvantages? Why? When should it be applied? Do such coatings hinder or facilitate repairs?*

work done with minimum interference with the operation of the yard. He should, therefore, participate equally with the supervisor who, while he may have excellent knowledge of the yard and its condition, cannot, because of many distractions, be as familiar with all of the details as the foreman should.

In the second case, in considering plans for both present and future work, the general foreman should consult freely with his section foremen, not only because of their familiarity with the details of their work, but partly so that the foremen will feel that they have a part in the planning. It is only natural that they should take a greater interest in the work when they come to do it if they have had a hand in the planning of it.

On the other hand, in the interest of good organization, if the general foreman ranks below supervisor, he and the supervisor should jointly do the over-all planning, leaving to the general foreman and the section foreman the responsibility of working out the details and of making arrangements with the yard management for carrying out the work without disorganizing the yard operations.

A yard foreman must possess several qualifications in greater degree than is required of other foremen. In the first place he must have tact and almost unlimited patience, for his patience will often be tried sorely in his relations with the yard forces, who generally object strongly to giving up tracks or other facilities, even temporarily, no matter how badly they need attention. On top of this, some yardmasters are much given to complaining to the superintendent about conditions which they will not let the foremen correct. Whatever the characteristics of the yard management, the tactful and patient foreman will fare much better than the untactful one.

A yard foreman should have personality that will command respect from those with whom he must deal. This does not mean that he must be quarrelsome or overbearing, for either will keep him in hot water most of the time. On the other hand, the weak and timid foreman has no place in a busy yard, for he cannot command respect and must always be falling back on his superior to make such arrangements with the yard forces as are necessary to carry on the work.

A yard foreman should have more than the average mechanical ability and quick mental reactions, because he is constantly being called upon to make repairs to turnouts and to replace or repair switch material that is broken or worn, and frequently to do this without stopping any of the yard operations for more than a few moments. He should have initiative for new situations are always arising in yards, that must be grappled with the moment they occur, giving no time for deliberate consideration. In addition, a yard foreman, more than any other class of foremen, should be completely honest. Controversial situations arise with great frequency in yard operations and it is essential that the word of the foreman be dependable, for oftentimes that of his opponents is not reliable, and it is a real asset to know that one can depend on the foreman's word.

Conserving Built-Up Roofing

In what ways can the life of built-up roofing be extended? What are the limitations on this class of work and as to when it should be done?

Use Care in Selection

By A. L. Sparks
Architect, Missouri-Kansas-Texas, St. Louis, Mo.

In general, the life of a built-up roof can be extended by observing suitable precautions when making the original installations. One of the principal advantages in purchasing a bonded roofing is the benefit of responsible supervision by men of considerable experience in the application of this type of roofing. Roofing is seemingly so simple that too often it is thought that, with modern improved types of seemingly fool-proof material, anyone can apply it. Almost any able-bodied man of reasonable intelligence can apply a roof that will turn water for some indefinite time, but it takes a mighty good roof to resist leaks successfully for a period of 20 years without some maintenance and without damage to the structure and its contents.

It is argued frequently that the applicator may die before a long-term guarantee runs out; this is true, but the experienced roofer uses the knowledge gained through years of observation and practical contact with the work. In most cases he has lived long enough to see what has happened to roofs installed 20 to 30 years ago, and what weaknesses they displayed and why.

The condition of the surface upon which the roof is laid has much to do with the life of the roof. This includes not only the smoothness, but strong nailing or fastening of the sheathing, freedom from spur cracks through which the wind may act, and provision for expansion and contraction.

We do not always exercise proper care in the selection of a type of roofing. In many cases the slope will demand a smooth top, while in others a gravel surface is the wisest choice, notwithstanding that a gravel surface is more difficult to repair. If the original roof structure was well built of high quality material, and long-life felt was applied correctly, the life of a gravel-surfaced roof may be extended by removing the gravel and applying additional cap sheets and coating them with an approved roof coating. The life of a smooth-top roof, where the felt is not dried out and peeling off, may be extended by applying an asphalt coating, of which there are many of recognized merit, prepared by reputable roofing manufacturers.

Some of these are known as cold-process coatings, which may be applied as they come from the containers; others require heating before application. Some products are thick and heavy enough to be applied with trowels and squeegees. When the heavier coatings remain plastic they are sometimes too sticky to walk upon, and when they dry hard they sometimes alligator, and eventually crack and peel off.

The service life of smooth-top asbestos felt, or other long-life smooth-top felts, can be prolonged by applying approved thin coatings regularly every two or three years, beginning when the roof is not more than three or four years old. This practice is as reasonable for the protection of a roof as lead and oil painting is for the protection of building siding, but it is frequently neglected.

There is a limit to the economy that can be obtained from treating the surfaces of old roofs, however. When the sheathing is old and the nails are

rusted or have become loose or partly drawn out by wind, swelling of the wood or other movement, little will be gained by continuing surface treatment. In such cases, it is generally more profitable to remove the roofing, repair and renail the sheathing, and make a new start with long-life roofing.

Begin at the Beginning

By Supervisor of Buildings

Conservation of the life of a built-up roof should begin with the preparations for its application. In the first place, only material of known dependability should be selected. There are plenty of reputable manufacturers to choose from, but there are others whose products are not of high quality, and these should be avoided to insure good results. Next, the roof structure should be stable and in condition to outlast the roofing. The sheathing should be of the tongue and groove type, and should be drawn up tight, so that there will be no cracks that will allow wind pressures from below to lift the roofing. The sheathing should also be nailed tightly, preferably with wrought-iron nails, and should have a completely smooth surface that will not damage the roofing or leave depressions that will interfere with drainage.

If applied correctly, a built-up gravel-top roof should require no attention for, say, seven or eight years, other than regular inspections. Bituminous materials exposed to the elements eventually lose some of their volatile components and in the course of time become hard and brittle. Before this stage is reached, it is advisable to clean off the gravel or slag and apply a suitable roof coating, restoring the gravel as the work progresses. This should be repeated at intervals of about four years. If a smooth-surface roof has been applied, the first coating should be applied after about four years and each succeeding coat should be repeated at intervals of about three years during the life of the roof.

Maintaining a Ballast Toe Line

In view of the present shortage of labor, to what extent is the maintenance of a ballast toe line now warranted? How can it best be maintained?

Advocates a Toe Line

By District Engineer

I am heartily in favor of a ballast toe line, for it has several advantages that cannot well be ignored. In the first place, it adds greatly to the appearance of the track and roadbed, and to the general appearance of the right of way. This is likely to be a real asset in the competitive situation with respect to passenger travel in the post-war period. I have heard some of those who are opposed to maintaining a ballast toe line say, some of them quite emphatically, that this is the only benefit it can claim. I do not agree that this is true, however.

I have observed that the man who does neat work generally does good work, and that, conversely, the one who allows his work to have a "sloppy" appearance turns out work that is also sloppy in quality. In other words, the maintenance of a ballast toe line tends to improve the quality of the work the foreman does. One of the objections often advanced to the maintenance of a toe line is the amount of labor involved, the claim being made that the toe line must be outlined with hand-laid rock or slag, or that sod must be cut and laid to delimit gravel ballast. That this argument is not sound is shown by the fact that many miles of neat and well-defined toe lines have been formed by laying down light planks and raking the ballast down against them.

Certainly, no one is likely to argue that ballast should be applied without being dressed, or that a gang should leave a job of surfacing where new ballast is not required, without restoring the ballast section. In either event, the establishment or restoration of the toe line involves so small an additional amount of labor as to be almost negligible.

There is one thing, however, that must not be overlooked—a neat ballast toe line requires that the shoulder of the roadbed be of ample width to support the ballast, and that it be level to avoid a wavy toe line. Obviously, in the long run, it will require some labor and effort to maintain the shoulder of the roadbed in satisfactory condition to make a neat toe line possible. But few will deny that it should be kept in this condition regardless of the ballast toe line. On the other hand, if this is not done, much ballast will be wasted, the appearance of the track and roadbed will be below par, the condition of the track will be less satisfactory, and the whole structure will give the impression of being badly run down.

Does Not Favor

By C. M. Chumley
Engineer Maintenance of Way, Illinois Central, Chicago

The practice of using cord or board gages and selecting by hand pieces of stone or slag ballast to form a straight toe line, or of cutting and placing a strip of sod to hold the toe line where washed gravel is used, is an extravagant luxury, affording little benefit other than appearance. It is not worth the cost, even when man-power is plentiful.

Today, in view of the present shortage of man-power, track labor should not be used for this purpose. However, care should be exercised when unloading ballast to insure as nearly uniform distribution as practicable, and when the track is being surfaced, it should be done with a view to leave a uniform ballast shoulder. Very little hand work is necessary to obtain this result, provided a self-propelled on-track power machine, equipped with spreader and shaper wings, or discing machines are used to equalize the ballast and provide the shoulder desired.

Should Be Well Defined

By G. S. Crites
Division Engineer, Baltimore & Ohio, Baltimore, Md.

Ballast costs a large sum of money by the time it assumes its final section in the roadbed. Because of this cost, as well as for track security, it is essential that the ballast section be well defined when installed, to insure that the amount of ballast planned for will be obtained and applied, and no more. This necessitates a well-defined toe line for the ballast section, because any ballast outside of the limits of the useful section is waste and may be more or less of a hazard.

It is desirable to maintain a full ballast section at all times for the security of the line and surface of the track. Under present conditions, when rail is scarce, rail conditions may not be as good as they should be, but a good and sufficient ballast section allows what labor may be available to be used in large measure and to best advantage in maintaining the older and weaker rail; in fact, this simply has to be done.

With this in mind, there should be no let-down in the maintenance of a well-defined and neat toe line. This should not be too difficult to accomplish, irrespective of labor conditions. Ballast sections tend to deteriorate most quickly in populous regions and under heavy traffic. In such places, however, there are almost always women workmen available to keep the shoulders of the embankment built up and leveled, and to keep the ballast dressed in good form. This is work that women are able to do readily and experience has shown that they are quite apt in its performance.

On stretches of track outside of congested areas there is less tendency for the ballast section to get out of form and there is no good reason why the labor available in such places cannot keep the ballast sections dressed up neatly. It pays to do this and, where a ballast toe line has been maintained in the past, it does not require much labor to do so. This is done by leveling up the shoulder to a uniform height and then using a suitable support, usually a 1-in. by 6-in. by 16-in. plank, against which to bring the ballast to a true line, as called for by the ballast section.

It has been found that a neat ballast section with a well-defined toe line is a real morale builder for any track gang. Usually, conditions that disturb the ballast section are not good or desirable conditions, and they call for correction as soon as it is practicable to make it.

Favors It Normally

By H. F. Fifield
Engineer Maintenance of Way, Boston & Maine, Boston, Mass.

There is nothing that makes a stretch of track ballasted with stone look neater and better kept than a good toe line. However, with the present shortage of labor, and the unusually heavy traffic that is now being handled, it is impossible to obtain sufficient help for this kind of work. The railway management that maintains a neat ballast toe line and at the same time allows its track to become rough, certainly would be open to criticism. I do not believe that the lining of the ballast toe by placing each piece of ballast by hand can be justified at any time or under any conditions.

Water Lines Under Tracks

What special precautions, if any, should be taken where water lines are laid under tracks? Why? Does the volume of traffic or the speed of trains make any difference?

Protection Pays

By J. P. Hanley
Inspector Water Service, Illinois Central, Chicago

Water lines should be installed carefully and protected against pressure and vibration from traffic when placed under tracks and, in some cases, when placed under highways. If the main is of large diameter and serves important uses, the cost of the protection can be justified easily. For example, if the main is 16 in. in diameter, and is under an interlocked track layout, the use of a concrete tunnel or of a 48-in. conduit of concrete or cast iron is justified. The conduit or culvert should be installed first and the pipe can then be jointed and pulled through it.

In cases where large city mains up to 36 and 48 in. in diameter are to pass under railway tracks, the railway will be justified in providing tunnel or conduit protection. This is especially desirable where soil load-bearing conditions are poor and traffic is dense, which will increase the pressure and vibration that is transmitted to the pipe. Most state highway departments require casing installations for water mains, so that if leaks occur the water will drain off at the ends of the casing, rather than remain directly under the slab.

The foregoing statements do not apply to the average railway installations of pipe lines up to 16 in. in diameter. In these cases, the joints should be so placed that they do not come directly under the track, the pipes being cut to length, if necessary, to provide this arrangement. The pipes should be supported substantially in the trench bottom and leak-prevention clamps should be used where conditions might result in joint leakage. Leak-prevention clamps are quite useful and are being employed extensively in present-day pipe installations.

It is good practice to make an approximate cost estimate for repairing leaks and for reconditioning the tracks after leak excavations are made and backfilled, where no special pipe protection has been used. This should then be compared with the decreased cost of pipe and track maintenance that may be expected to result from an initial effective system of protection. In making this estimate, due weight should be given to the nuisance value of leaks and soft spots, as well as to actual out-of-pocket costs. Such a comparison will indicate that special pipe protection is economical in many cases.

Avoid This Situation

By Supervisor of Water Service

Wherever possible, the placing of pipe lines under tracks should be avoided. There are two reasons for this, (1) the possibility of damage to the tracks as a result of leaks in the pipe lines, and (2) because of the difficulty and expense entailed in making repairs to the pipe line. Obviously, there are cases where there is no alternative to placing the pipe under a track or tracks, and in such cases every precaution should be taken to protect both the pipe and the track.

Just what action should be taken will depend largely upon the character of the soil, the size of the pipe, the pressure carried and the depth to which the pipe is to be laid. Pipe lines 8 in. and smaller do not present a troublesome problem under good soil conditons, if they are laid to a depth of 5 ft. or more below the ties and the pipe is laid on a firm foundation, with the earth tamped firmly in place over and around the pipe. It is desirable that the pipe trench be as narrow as practical to avoid, as much as possible, disturbing the natural ground.

The pipe should be laid so that no joints come under the track. Larger pipes should be encased in carrier pipes or conduits capable of supporting the roadbed, track and traffic. The inside diameter of the carrier pipe should be at least 2 in. larger than the largest outside diameter of the water pipe or couplings. Where the ground is soft, as in fills or in swampy ground, the pipe should be enclosed in a carrier pipe, regardless of its size. The carrier pipe should be open at both ends to permit any water caused by leaks or a failure of the pipe to drain away to a point well outside of the roadbed, and thus away from the track.

Cribbing is sometimes provided over the pipe line by driving piles or by building up cribbing on each side of the pipe to carry the weight of the track. While the foregoing comments apply in general to all tracks,

the protection of the track and pipe line is of particular importance on heavy-traffic high-speed track. The protection of pipe lines laid under the tracks necessarily represents an increase in the cost of laying, but it will pay in the long run in less maintenance for both the track and the pipe.

Should Tampers Be "Spelled"?

Where surfacing requires continuous use of tie tampers, should relief men be provided to "spell" the men operating the tampers? Why? How long should the rest periods be?

Has Found It Desirable

By T. E. McMANNIS
Division Engineer, Central of New Jersey, Jersey City, N. J.

Where tie tampers are being used for out-of-face surfacing, we have found it most desirable occasionally to change the men operating the tampers. Even though the modern designs of tamping tools are not particularly burdensome to operate, they are fatiguing if the men are kept with them for too long a time at a stretch. On the other hand, some men naturally like machines and prefer to continue to operate the tampers rather than do any kind of hand work. However, in the interest of efficiency, it is desirable to insist that all men be relieved from operating the tampers occasionally. Our arrangement is to have a third man working with each two tampers, to feed them ballast when this is necessary, to help move hose lines and to do the many incidental jobs necessary with such track work. These three men work as a team and change about as they desire. If there is any hesitation on the part of any one of them to do his part in the operation of the tie tampers, it will be desirable for the foreman to direct the change.

Almost entirely, all of our out-of-face track raising and surfacing is done under traffic and there are frequent interruptions to allow trains to pass. Under these circumstances the men get occasional relief without a change in operators. Under these circumstances it is my belief that the operator should be "spelled" about every two hours. When a track is available for continuous work, it is probably desirable that the operator be relieved at shorter intervals. Under the arrangement mentioned, the men would have rest periods from operating the tampers of two hours, but if they change more frequently, the rest periods should be shorter. Either arrangement should be satisfactory.

Our experience with tie tampers for out-of-face work has been entirely with the pneumatic type and the foregoing comments have reference to that type of tool only. We have a limited number of tampers of the unit or individual gas type, that have been used for spot work. I believe that it is necessary to provide relief at shorter intervals for men who are operating the unit-type tools, especially in hot weather. Otherwise, however, there seems to be no good reason why this type of tamper cannot be used for out-of-face work as well as the pneumatic type.

Men Will Tire

By SUPERVISOR OF TRACK

While the newer designs of pneumatic tamping tools are easier on the operator than those that we had in service a few years ago, they still tend to tire the men if they use them without relaxation for too long a time. For this reason, it has been my practice to have the foremen whose gangs are equipped with pneumatic tamping tools, arrange their men so that no one of them uses such a tool continuously for more than two hours. When this can be done, the time for continuous use is reduced to one hour, but with some of our gangs the labor situation makes this shorter interval impracticable. The same practice has been followed where the gangs are equipped with tampers of the unit or spot type, since the weight and vibration are comparable to those of the pneumatic type.

At present I am using only the types of tools mentioned. Under a former assignment, however, I had a line ballasted with gravel, upon which we employed electric tampers. In some respects I think they were easier to handle, but it was my observation that they tired the men in about the same measure as the other types, and we followed the same practice of spelling the men which has been described.

Where section gangs are equipped with tampers of the unit type, the tamping tools are seldom used with the same continuity as those employed by the larger surfacing gangs, so that the practice of spelling is not so important, yet it should always be followed if the tools must be used continuously for more than two hours.

Removing Paint from Buildings

What is the best method for removing paint from exterior building surfaces, preparatory to painting? Interior surfaces? What are the advantages? The disadvantages?

Uses a Propane Torch

By L. G. BYRD
Supervisor of Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

An adequate cleaning job is essential to appearance as well as for long life for the new paint that is to be applied. In the past, the preparation of both exterior and interior woodwork to receive new coats of paint has been a very difficult job. This has been primarily because the wood surfaces were painted originally before the wood was well seasoned, or because of failure to stop leaks between the walls. Another reason has been the use of inferior paint and also that of applying good paint over an inferior grade of paint or varnish.

It was also the practice on most roads only a few years ago to sand the exterior surfaces of buildings, or the last coat of paint, to a height of six to eight feet above the level of the platform or the building foundation. When sanding went out of vogue, it became necessary to remove all of the paint over the entire sanded area, and this is not a very easy job.

For many years we employed blow torches, such as those used by plumbers, but this is not only quite expensive, but it creates a fire hazard. Furthermore, this practice was not satisfactory because the hot flame and the force with which it impinged upon the surface made it almost impossible to prevent scorching the wood in some areas, which almost invariably showed through the new paint, even after it dried, or to avoid spotting the walls around the interior woodwork.

Another method frequently used to

remove paint is the application of a chemical liquid compound commonly known as a paint remover. For some classes of work this has been quite satisfactory, especially for removing paint and varnish from window and door casings and settees, when they could be removed to the outside of the building. However, there is a considerable fire hazard in the use of such a compound for interior surfaces because of the ease with which it may be ignited.

The most satisfactory method we have used to date for the removal of paint and varnish from both exterior and interior surfaces is the propane (or butane) torch. The gas comes in cylinders similar in appearance to those used for shipping oxygene and acetylene. Each one contains about 20 lb. of compressed gas, which is sufficient for 24 to 54 hr. of continuous burning, depending on the torch that is employed. The gas is already under pressure, so that there is no pumping to be done and no generating of the burner. It is ready to use as quickly as one can open the valve and light the torch which, by the way, does not blow out in the wind. Two or more torches can be used at the same time from one cylinder if it is necessary.

Use a Gas Flame

By Building Inspector

Many methods for removing paint have been tried in the past, a few of them having some advantage, but all afflicted with serious disadvantages. In many cases, the only way to remove all of the old paint, as is often necessary, was to burn it off, but the blow torches that were used, and the only ones available, gave such high temperatures, and the flame was shot out with such force, that not only was the paint burned off but the wood surface was charred or scorched enough that the overheated area was sure to show through the new paint, even when three coats were applied. In some cases, where dark paints were used, this was not quite so objectionable as where the paint was light.

More recently, we have been using propane torches and have found them superior to any method we have ever tried. They heat the paint to a temperature that makes it blister and boil under the flame and loosen from the wood surface to such an extent that it can be removed easily with a putty knife, a spatula or other suitable scraper. While the temperature of the burning gas is high (I understand it reaches to about 3,400 deg. F.), the torches do not have the blow pipe action of the plumber's torch, which we used previously, so that the wood is not scorched unless the torch is held in one place too long or is allowed to come in contact for an appreciable interval with the cleaned wood surface.

One man can easily handle a torch and a scraper, and two or three torches can be taken simultaneously from a single cylinder. The paint can be removed almost twice as rapidly when using these torches as with the old blow torch. The torches are light and are fitted with a pilot light, so that gas is used in volume only while the paint is actually being heated.

Care should be exercised not to allow the flame to enter cracks in the siding, joints between members or to come in contact with loose or flammable materials, such as paper, cobwebs, birds nests, etc., which should all be removed before the cleaning of the paint is started.

How to Teach Safety

Through what methods does the foreman attain his greatest success in teaching safety to his men? Why? In what ways do some foremen nullify their teaching?

Follow Up the Instruction

By I. H. Schram
Chief Engineer Maintenance of Way, Erie, Cleveland, Ohio

The question of teaching safety has long been considered and there are many tried and proved methods for doing so. Generally, they embody talks by the foreman, the reading of safety rules, etc. In addition, there are several other things that can be done. Our Job Methods Training course has taught us that these methods can be brought into use in the gangs. There are four steps for doing this:

1. Prepare the worker for the job; that is, get him in a suitable frame of mind for working.
2. Present the job. This includes not only telling the man how to perform the work, but showing him by examples how to do it and the principles and key points of the work. Furthermore, this should be repeated until the man really knows what he is to do.
3. Try him out to see how he performs the work.
4. Follow him up to see that he does as he is told and that he continues to follow his teaching.

In addition, there is the general organization of the gangs. In this management can prepare and teach foremen so that they will have the desired background for a general understanding of their work. We have found this to be particularly advantageous from the standpoints of both economy and safety.

Must Show Them

By A. E. Perlman
Chief Engineer, Denver & Rio Grande Western, Denver, Colo.

Our experience convinces us that there is no method of teaching safety equal to that of actually showing the men how the work can be done safely, and then have them do the work under observation to make certain that they know and understand the right and safe way. If the foreman actually shows the men how to perform the task, they become convinced that he knows whereof he speaks and this leaves no argument about doing the work in accordance with his instructions.

However, by not following his own advice, and by not requiring his men to follow his instructions, even in emergencies, a foreman will quickly nullify all that he has taught the men about safety.

Will Bear Repetition

By Malcolm E. Condon
General Yard Foreman, Erie, Croxton, N. J.

Usually, it is not enough just to tell a man the safe way to do work, although when the foreman shows him, the average workman will understand what is required. However, by repeating the instruction the idea will be implanted more firmly in the work-

man's mind. A discussion of the safety features involved in any particular operation will disclose to the foreman how well the workman has grasped the salient points in doing the work safely, and how well he recognizes the hazards involved in doing the work in an unsafe manner.

It is also imperative that the foreman check each man in his work to insure against a return to unsafe practices. Previously acquired habits are difficult to change, even where unsafe methods are involved, this being particularly true in the case of older men. In consequence, while a man may change to the safe way for a time, it is easy for him to revert to his unsafe habits. For this reason, he must be checked frequently and admonished at the first sign of such reversion to unsafe practices.

Another important consideration that must always be kept in mind is the popular misconception that in an emergency, or where a job must be done quickly for other reasons, the safe way of doing the work can be sacrificed for a quicker method that may be hazardous. The foreman must stop any such tendency at once, for the men often fail to realize that it is better to take a little more time or to expend a little more effort to do the job safely, than to take a short cut that holds inherent hazards for themselves and their fellows.

One of the serious mistakes of some foremen is their unfortunate failure to practice what they teach. One departure from the safe method of performing a task, if made by the foreman himself, is enough to nullify all or most of his teaching as long as the episode remains in the memory of the men. The safe way is the only way to do a hazarous job, whether it is done by the foreman or by the workmen. The age-old excuse that "we had to get the job done in a hurry" is not a satisfactory excuse, regardless of whether an injury occurred, for harm is done in the minds of the workman, in that to a greater or less extent their concepts of safety are broken down.

Effect of Over-driving Piles

What are the effects of over-driving wood piles? Concrete piles? Steel piles? How can over-driving be detected?

Depends on Material

By C. C. Westfall
Engineer of Bridges, Illinois Central, Chicago

The term over-driving is not a clear-cut expression, and must be used with certain reservations or qualifications. One interpretation might be that any driving over a more or less arbitrary number of blows per foot would be over-driving. The extreme interpretation could be that so long as the pile is not damaged, it is not over-driven. In a great many cases, it is necessary to drive the piles to a certain penetration, and in some materials this will necessitate punishing the piles much more than seems desirable, yet with no apparent bad effects upon them. It is not always safe to be governed by the number of blows per foot, which some formulas indicate as sufficient for the specified pile load, as this result may be obtained with such shallow penetration that, in the case of trestle piles, they may, after some years' time, begin to churn and settle.

The effect of over-driving piles will depend upon the character of the material in which the pile is being driven. If the material offers strong point resistance, the over-driving of a wood pile is likely to destroy the tip end, causing it to broom, or the pile may break. A hardwood pile will probably split if it is over-driven. If the resistance to driving is caused more by skin friction than by point resistance, the damage to the pile will probably be at the head. In some cases a wood pile may break and the upper part drive past the break, giving a false indication of additional penetration. There is also the possibility that, because of the presence of wind shakes, the outer shell of the pile will separate from the heart.

There seems to be no general rule for determining whether the pile is being damaged by driving, other than that the driving of the piles should be under the observation of an experienced man who can tell by the behavior of the pile as it is being driven, whether it is being damaged.

A Matter of Experience

By General Inspector of Bridges

The detection of over-driving in piles is not an exact science, but is usually a matter of judgment, based on experience, on the part of the pile-driver foreman, or of the operator, who should also be a man of experience. Yet even the most experienced men are sometimes unable to detect whether a pile is being over-driven. Over-driving is most likely to occur where piles must be driven to refusal, or where they bring up against a stratum of shale or hardpan.

Where trestles are to be redriven, information concerning the material through which the piles must be driven is usually available, although this is not always true. I recall several instances where trouble was encountered because this information was not available, or that which was given was erroneous. Where the character of the underlying strata is not known, core borings should always be made before the piles are ordered. The information obtained from the cores will allow an intelligent decision to be made about the kind and length of the piles that will be most suitable for the job.

Indication of over-driving a wood pile with a drop hammer is generally the brooming of the head of the pile. Other damage will depend in some measure on the character of the material through which the pile is being driven. If the material is hard and the point resistance is greater than the skin friction, the lower end of the pile is quite likely to be broomed. In some cases, I have seen piles that were being driven under these conditions shear diagonally near or below the middle of their length. In this event a pile may seem to be going down with a moderate amount of resistance when, as a matter of fact, it is not in condition to carry any load.

Except for the brooming at the end, the same damage may be caused by a steam hammer. I have also seen a pile practically shredded below the ground line as a result of wind shakes and excessive driving. It is usually not difficult to determine when a pile brings up against rock, by the change in the reaction of both the hammer and the pile, yet this is not always a definite indication, particularly if the pile is of wood that brooms easily or has too small a tip.

In general, the effect of over-driving a concrete pile is to shatter the concrete at or near the head of the pile and to loosen the bond between the reinforcing and the concrete. I have also seen concrete piles that were cracked or broken along horizontal planes at intervals along their whole length as a result of over-driving. I have had no experience with steel piles, although I have seen a number of them driven by others, and I have gained the impression that they are able to withstand more punishment than wood or concrete piles.

What Our Readers Think

Advantages of Sub-Ballast

Mahasamund, C.P., India

TO THE EDITOR:

I have read with deep interest the discussions on sub-ballast, by Messrs. Sitton and Crites, which were presented a number of months ago in *Railway Engineering and Maintenance*. These articles contain much information of value to every maintenance officer.

So far as I am aware, it is not the general practice on any of the Indian railways to use sub-ballast on main-line tracks. On the other hand, after construction, it is customary to lay the new tracks on moorum, which is a reddish gravel commonly used as ballast on unimportant lines. Trains are allowed to pass over this moorum at low speed until the roadbed has become consolidated, and stone ballast is then applied over the moorum. When this is done, the moorum becomes, in effect, sub-ballast. In many cases, however, the stone ballast is placed directly on the new roadbed, no consideration being given to the use of sub-ballast.

Again, there is no system on the Indian railways of using boulders of one to two cubic feet over the tops of embankments to strengthen the roadbed, before the stone ballast, ranging in size from 1 to 1½ in., is placed, as is done on many foreign railways. This practice is followed only when the soil is black cotton, and is done generally some years after construction.

I am a permanent-way inspector, in charge of a section of road between Khariarroad and Raipur, on a line of the Bengal-Nagpur, extending from Vizagapatam to Raipur. The normal speed over this track is 50 miles an hour. The track is supported on 1 to 1½-in. stone ballast, with steel sleepers (ties) of eight different designs, with steel rails 36 ft. long, weighing 90 lb.

About 30 miles of the track on this line is laid on a roadbed that is constructed of black cotton soil, and this stretch of line is giving considerable concern to maintenance officers. During the summer as the material dries out, cracks 3 to 4 in. wide occur all over the roadbed, allowing the ballast to drop into them, thus leaving no ballast for packing (tamping).

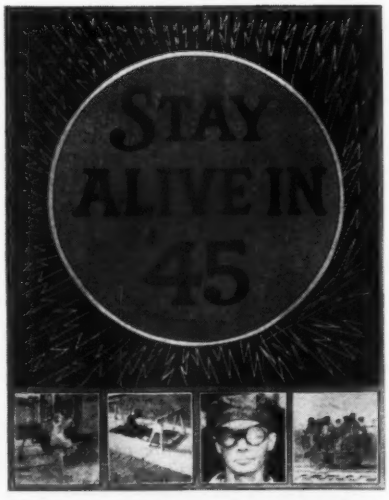
These cracks occur in serpentine form, causing uneven settlement of the track. During rains, the material absorbs water and swells, unevenly at many places, especially at approaches to bridges, and becomes quite troublestome. In fact, near the bridge ends, we must raise the track during dry periods and cut it down again during wet weather.

Granite screenings containing a high percentage of dust, as mentioned by Mr. Sitton, are not used as sub-ballast in India. To overcome the difficulty we have with this black cotton soil, we are now using river sand as sub-ballast. In making the installation, the stone ballast is first raked out from under the track; the sand is unloaded on the cleared roadbed and the track is raised, all of the packing being done with sand; as the final operation, the stone ballast is returned to the track for dressing over the sand. This method is commonly known as sand blanketing.

The idea of using locomotive cinders as sub-ballast has been advanced and in many respects it is a good one, because of its effect in consolidating the roadbed; and it is reasonably cheap. In our case, however, it is not suitable, for the cinders cause rapid corrosion of the metal sleepers if they are allowed to come in contact with them. For this reason, we consider it undesirable to employ cinders as sub-ballast, since it is likely that a certain amount of the sub-ballast will become mixed with the top ballast.

I shall be very grateful to any American engineers who are familiar with soil of this character, if they will give me advice as to better methods that will improve the condition I have described.

N. B. RAO
Permanent Way Inspector,
Bengal-Nagpur Railway



This Poster, No. 258, constitutes the March Installment of the "All the Year-Every Year Safety Program" of the Safety Section, Association of American Railroads.

New Book

A.W.P.A. Proceedings

PROCEEDINGS of the American Wood-Preservers' Association for 1944. 492 pages, 6 in. by 9 in., illustrated. Bound in cloth. Published by the Association, 1427 Eye Street, N.W., Washington 5, D. C. Price $6.

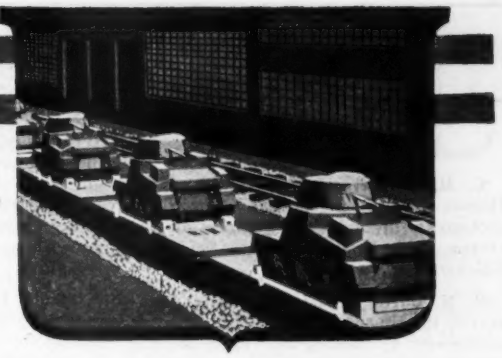
THIS volume contains 31 papers and committee reports, together with the discussions that followed their presentation at the fortieth annual meeting of the association at Chicago on April 26, 1944. These reports and papers cover a wide range of subjects relating to the treatment of wood to make it resistant to decay and to attack by insects or fire.

Among the reports of special interest to maintenance officers are those on the fireproofing of timber, which was given a place of major importance on the program at this meeting; on an international termite exposure test; on service records of ties, posts and marine piles; and on the pressure treatment of ties, piles, posts and lumber.

Among the papers of special interest to maintenance men are the following: Information on Pentachlorophenol as a Wood Preserving Chemical, by Ira Hatfield, Monsanto Chemical Company; Studies in the Biological Environment in Treated Wood in Relation to Service Life, by Henry Schmitz, Herman von Schrenk and A. L. Kammerer; Recent Treatment Practices on the Chesapeake & Ohio, by H. M. Church, general supervisor of bridges and buildings of this road; and six papers relating to the fireproofing of wood.

The volume also contains a statistical section and a complete report of the business session of the meeting. The statistical section contains the thirty-fifth annual report, for 1943, of the quantities of wood treated and preservatives used in the United States, together with a complete list of the wood-preserving plants in the United States, Canada and Mexico, compiled by R. K. Helphenstine, Jr., of the Forest Service, United States Department of Agriculture.

NEWS of the Month



Seventh War Loan Starts April 9

When the Seventh War Loan campaign is placed in effect on April 9, it will have the unified support of the labor-management war bond committees of 62 railroads and their subsidiaries. These committees have accepted the responsibility for initiating a quota system for extra bond purchases through the payroll savings plan, under which railroad employees will be asked to purchase extra bonds on a sliding scale based upon their average monthly earnings, rather than to purchase an extra $100 bond as in past drives. The national quota for this drive, which extends from April 9 through July 7, is $14,000,000,000, of which $4,000,000,000 is expected to be sold through the payroll savings plan.

More Streamliners Announced

Another of the country's famous "name" trains will be streamlined after the war, according to a recent joint announcement by the Missouri Pacific and Texas & Pacific of plans to purchase four new passenger trains at an estimated cost of $9,000,000 to replace the present equipment on the road's Sunshine Special operating between St. Louis, Mo., and Texas points. Plans call for two daily trains from St. Louis, one to Dallas and Ft. Worth, Tex., and the other to Houston and San Antonio, Tex. Corresponding types of light-weight sleeping cars and coaches will operate on connecting trains to and from Memphis, Tenn., El Dorado, Ark., Shreveport and Lake Charles, La., and Galveston, Tex. Equipment to be purchased includes four 4,000 hp. and three 2,000 hp. Diesel-electric locomotives, 32 sleeping cars, two sleeper-lounge cars, two diners and five diner-lounge cars, 21 coaches, and eight express, baggage and mail cars.

General Gray Appointed Director Military Railway Service

Brigadier General Carl R. Gray, Jr., has been appointed to the newly created post of Director General, Military Railway Service, United States Army, according to a recent announcement by Major General Frank S. Ross, Army Chief of Transportation. In his new position, General Gray directs the First and Second Military Railway Services in continental Europe.

General Gray, prior to his recent appointment, has been in charge of the First Military Railway Service. These units, under his leadership, accompanied army shock troops in the initial African invasion at Casablanca and have supported land and air forces of the U. S. Army through eight countries in the Mediterranean area. With the invasion of southern France, General Gray moved his forces in to supply the Sixth Army Group, and it was in October, 1944, while operating in that area, that his men became known as the First Military Railway Service, to avoid confusion with the organization operating in northern France under Brigadier General Clarence L. Burpee, which became known as the Second Military Railway Service.

General Gray is the holder of numerous personal awards in recognition of his outstanding contributions to the Allied war effort. These include the Distinguished Service Medal and Bronze Star for his work in the Italian and southern France campaigns. In civilian life General Gray had served with both the Frisco and the Burlington lines, and at the time he entered military service he was executive vice-president of the Chicago, St. Paul, Minneapolis & Omaha.

New Rules For Deferments Of "Key" Employees Under 30

A plan has been placed in effect under which, at the request of the Office of War Mobilization and Reconversion, the Office of Defense Transportation is acting as the claimant agency and certifying authority for recommending draft deferment of "indispensable" workers under 30 in the transportation and related industries.

Under the plan the carriers were asked to submit to the O.D.T. for certification, lists of key workers under 30, in the order of their indispensability, placing those whose loss would be most serious first on the list. The lists, which were to be prepared prior to March 20, were examined by the O.D.T.'s Division of Transport Personnel and "fixed percentages" of those on the lists were assigned for certification. Upon notification of the applicable percentages, the carriers were to file with the O.D.T. two sets of Selective Service Form 42-A Special (Revised) prior to April 1, accompanied by a certification that such a submission is being made to only one claimant agency. Following receipt of the Form 42-A, the O.D.T. will certify to the local draft boards, as indispensable sufficient men to meet the "fixed percentages" assigned to the individual carriers. Final decision as to the deferment of any individual worker remains in the hands of the local draft board and is subject to appeal as before.

Santa Fe Places Major Bridge in Service

One of the largest railway bridges built in recent years was placed in service on March 7, when regular train service over the Atchison, Topeka & Santa Fe's new Colorado river bridge at Topock, Ariz., was inaugurated. Located on the main line of the Santa Fe, the new double-track bridge was constructed to replace an existing single-track structure nearly 55 years old, which, because of structural deficiencies, placed serious limitations on the size of locomotives that could be used in the territory.

The new bridge, which has a total length of 1,506 ft., was an engineering work of considerable magnitude, involving 14,077 cu. yd. of foundation excavation, the placing of 17,878 cu. yd. of concrete in the substructure, and the erection of 6,506 net tons of bridge steel. It consists of three 350-ft. deck-truss spans over the channel, a 50-ft. beam span and a 100-ft. deck-girder span at the east end, and three 100-ft. deck-girder spans at the west end. The seven piers and two abutments are of concrete construction and are supported on reinforced concrete cylinders which are all carried down to bed rock, some through a considerable depth of silt and unstable material. The depth to bed rock was so great, being 123 ft. below the surface of the water at one pier, that is was necessary to employ pneumatic methods in sinking most of the caissons.

American Railroads to Train Group of 110 Chinese Engineers

The first 39 of a group of 110 Chinese engineers who are to be trained on American railroads have arrived in this country, according to Col. J. Monroe Johnson, director of the Office of Defense Transportation. The other trainees are expected to follow later in the year, he said. Brigadier General Charles D. Young, deputy director of the O.D.T., will be in general charge of the program.

The Chinese, all of whom speak English and have had a minimum of three years continuous railroad experience, will be trained on 12 railroads. Western railroads, which will take a total of 60 of the trainees, include the Burlington, the Milwaukee, the Illinois Central, the Southern Pacific, the Union Pacific and the Great Northern. The other 50 trainees will be assigned to the Pennsylvania, the Baltimore & Ohio, the New York Central, the Louisville & Nashville and the Southern.

Changes in Railway Personnel

General

C. H. Mottier, chief engineer of the Illinois Central System, has been elected vice-president and chief engineer of the system, with headquarters as before at Chicago.

R. H. Carter, assistant terminal manager of the Illinois Central, at Chicago, and an engineer by training and experience, has been promoted to superintendent, at Water Valley, Miss.

Garrett B. Wall, Jr., division engineer on the Chesapeake & Ohio, at Clifton Forge, Va., has been appointed assistant to the vice-president in charge of real estate, tax, magazine and legislative matters, with headquarters at Huntington, W. Va.

Engineering

C. H. Fox, district engineer of the Manitoba district of the Canadian Pacific, has been appointed special engineer, with headquarters as before at Winnipeg, Man.

F. W. Tomlinson, Jr., section engineer on the New York zone of the Pennsylvania, has resigned to become assistant engineer on the Northern Pacific, at Livingston, Mont.

W. A. Smith, roadmaster on the Canadian Pacific at Lanigan, Sask., has been transferred to the office of the assistant chief engineer at Winnipeg, Man., for special duties.

F. L. Cagwin, district engineer, Scranton district, of the New York, Ontario & Western, has retired because of ill health, and the position has been abolished. **D. W. Fagley, Jr.,** assistant engineer at Norwich, N.Y., has retired because of ill health, and the position of assistant engineer there has been abolished.

C. E. Hise, assistant chief engineer of the Chicago, St. Paul, Minneapolis & Omaha, who has been serving with the armed forces, has returned to the Omaha as division engineer of the Eastern division, with headquarters at St. Paul, Minn. **W. H. Huffman,** division engineer of the Eastern division, has been transferred to the Western division, with headquarters as before at St. Paul, succeeding **H. H. Hall,** who has been assigned to other duties.

Francis Martin, whose appointment as assistant division engineer on the Delaware, Lackawanna & Western, at Buffalo, N. Y., was reported in the March issue, was born at Saugerties, N. Y., on July 14, 1903, and studied engineering at a university night school, becoming a licensed professional engineer and land surveyor in New York state. In 1920 he entered railway service as a chainman on the Lackawanna and was promoted to rodman in 1921 and to transitman in 1923. In 1927, he was appointed an instrumentman and from 1933 to 1941 he served as a draftsman. Mr. Martin left railway service in the latter year to become an equipment engineer for the Curtiss-Wright Corporation at Buffalo, N. Y., and the following year he became chief engineer of Metallizing Service Company, Buffalo, remaining with that company until he returned to the Lackawanna on February 1, as assistant division engineer at Buffalo.

Harold J. Bogardus, whose promotion to assistant chief engineer of the Pere Marquette was announced in the March issue, was born at Grand Rapids, Mich., on September 23, 1892, and was graduated from the University of Michigan in 1915. He entered railway service in 1916 with

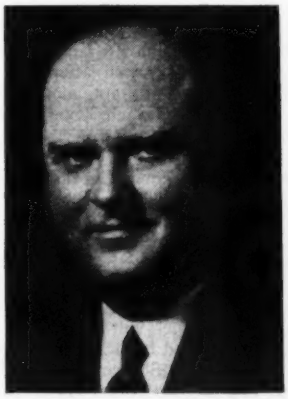
Harold J. Bogardus

the Pere Marquette as an extra-gang timekeeper, subsequently serving as transitman, and later being promoted to assistant division engineer in 1919. Mr. Bogardus was advanced to division engineer in 1926, with headquarters at Saginaw, Mich. He was promoted in 1944 to assistant engineer maintenance of way, with the same headquarters, and remained in that position until his new appointment, effective February 15.

Walker Paul, whose promotion to assistant to the chief engineer of the Southern Pacific, at San Francisco, Cal., was reported in the March issue, entered the employ of Stone and Webster Construction Company in 1912, during the construction of the San Joaquin and Eastern (now abandoned), working as rodman, instrumentman, inspector, foreman and chief of party. Subsequently he engaged in construction work on various hydro-electric power and highway projects in California, Utah and Idaho. In July, 1922, Mr. Paul became a draftsman and assistant land appraiser on the Southern Pacific, with headquarters at San Francisco, and in 1924, he was promoted to land appraiser, remaining in that position until July, 1941, when he was advanced to executive assistant in the office of the president.

Thomas P. Watson, whose promotion to assistant to the chief engineer of the Central region of the Pennsylvania, at Pittsburgh, Pa., was reported in the March issue, was born at Chester, Pa., on November 21, 1886, and entered railway service on the Pennsylvania in July, 1902. From January, 1903, to January, 1918, he served successively as chainman, rodman, levelman and transitman on location and construction under the direction of the office of the chief engineer of the lines East. From January, 1918, to July, 1919, Mr. Watson was a captain in the Transportation Corps of the A.E.F., and at the termination of his military service, returned to the Pennsylvania as an assistant engineer at Pittsburgh, Pa. In 1927, he was promoted to principal assistant engineer of the Philadelphia improvements and in 1934 he was made assistant engineer on the Central region, with headquarters at East Aurora, N.Y., remaining there until his recent promotion.

Lawrence Sugg Jeffords, whose promotion to chief engineer of the Atlantic Coast Line and the Charleston & Western Carolina, at Wilmington, N. C., was reported in the March issue, was born at Florence, S.C., on July 2, 1892, and entered railroad service in March, 1910, in the engineering department of the Atlantic Coast Line. Subsequently he held various positions, including rodman, concrete inspector, levelman, transitman, resident engineer, assistant division engineer, roadmaster, and assistant engineer, mainteance of way, until January, 1921, when he was promoted to engineer, maintenance of way, of the Charleston & Western Carolina. In January, 1925, he was named superintendent of that road, remaining in that post until



Lawrence S. Jeffords

July, 1940, when he became general superintendent. In September, 1944, he was appointed chief of personnel of the Atlantic Coast Line and the Charleston & Western Carolina, the position he held at the time of his recent promotion.

Kenneth A. Truman, roadmaster on the Canadian Pacific, at Manyberries, Alta., has been promoted to division engineer at Medicine Hat, Alta., succeeding **W. L. Codington,** whose promotion to district engineer of the Manitoba district, with headquarters at Winnipeg, Man., was reported in the January issue. Mr. Truman was born at Craik, Sask., on June 8, 1911, and was graduated from the University of Manitoba in 1935, with the degree of Bachelor of Science in Civil Engineering. He entered railway service in May, 1929, as a chainman in the construction depart-

(Continued on page 396)

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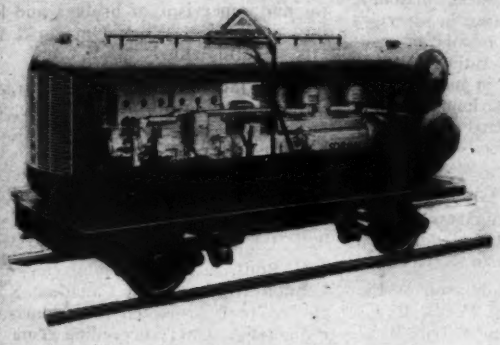

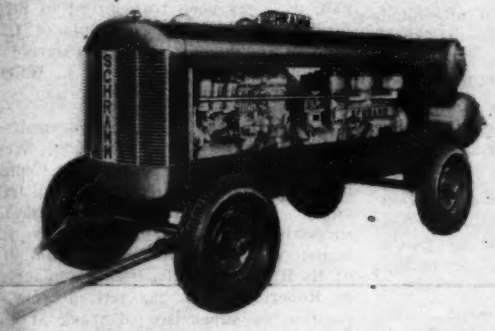

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ment of the Canadian Pacific, and during the summers of 1931 to 1935, he was employed as a laborer, attending University during the winters. In May, 1937, he became a transitman in the operating department, serving at Calgary, Alta., Regina, Sask., and Nelson, B. C., until July, 1943, when he was promoted to relieving roadmaster on the Lethbridge division. In September, 1943, he was again made a transitman, at Nelson, and in January, 1944, he was advanced to roadmaster at Manyberries.

James W. Wiggins, whose appointment as assistant to the chief engineer of the Boston & Maine, at Boston, Mass., was reported in the March issue, was born at Houlton, Me., and was graduated in 1930 from the University of Maine. He

James W. Wiggins

entered railway service that same year on the Erie and, in 1933, went with the Bangor & Aroostook as a rodman. In 1936 he went with the Maine Central as assistant engineer, returning to the Bangor & Aroostook as superintendent of bridges and buildings in 1938. Mr. Wiggins was promoted to principal assistant engineer of that road in 1940, which position he held until he resigned to go with the Boston & Maine as assistant to the chief engineer.

Harold S. Ashley, division engineer of the Terminal division of the Boston & Maine, whose headquarters at Boston, Mass., has been promoted to engineer of track, with the same headquarters, succeeding **Guy H. Watson,** who retired on February 23, after more than 42 years of railroad service. **Raymond H. Mitchell,** assistant division engineer of the Portland division at Dover, N. H., has been advanced to division engineer at Boston, replacing Mr. Ashley, and **Foster R. Spofford,** supervisor of bridges and buildings of the Terminal division at Boston, has been promoted to assistant division engineer at Dover, relieving Mr. Mitchell.

Clarence M. Segraves, whose promotion to assistant engineer of structures of the Delaware, Lackawanna & Western, with headquarters at Hoboken, N. J., was reported in the March issue, was born at Oneonta, N. Y., on August 24, 1896, and graduated in structural engineering from Pratt Institute in 1920. Mr. Segraves also took a special course in mechanical and machine design given by the American Society of Mechanical Engineers, and a special course in electricity, given by the American Institute of Electrical Engineers. In 1920 he went with the New Jersey State Highway Commission, which he served as a bridge designer and draftsman until March 15, 1926, when he went with the Lackawanna as a designer. Since that time, Mr. Segraves has been engaged in the designing and detailing of steel, masonry, concrete and timber structures, in supervising the construction and repairs of such structures, inspecting and rating railroad and highway bridges, and in making general studies and estimates for improvements. He is a licensed professional engineer in the State of New Jersey.

Track

J. E. E. Brazeau, roadmaster on the Canadian National, at Richmond, Que., has retired after 50 years of service.

Stanley B. Harrison, roadmaster on the Canadian Pacific, at Grand Forks, B. C., has been transferred to Salmon Arm, B. C.

Earle T. Rucker has been appointed supervisor of track on the Chesapeake & Ohio at St. Albans, W.Va., succeeding **W. M. S. Dunn,** who has resigned.

W. R. Hunter, an assistant roadmaster on the Union Pacific, has been promoted to roadmaster, with headquarters at Cache Junction, Utah.

M. F. Ward, acting superior of track on the Illinois Central, at Paducah, Ky., has been promoted to supervisor of track, with the same headquarters, succeeding **W. Holt,** who has retired.

W. R. Lash has been appointed assistant supervisor of track on the Pittsburgh & Lake Erie, at Beaver Falls, Pa., succeeding **John L. Lash,** whose death is reported elsewhere in these columns.

A. W. Anthony has been appointed supervisor of tracks, Southern district, of the New York, Ontario & Western, with headquarters at Middletown, N. Y., and **Michael Urda** has been appointed acting supervisor of tracks, Scranton district, with headquarters at Childs, Pa.

V. I. Kessinger has been appointed roadmaster of the First district and branches of the Southern Kansas division of the Atchison, Topeka & Santa Fe, succeeding **H. W. Green,** who has been transferred to the Second district, with headquarters as before at Chanute, Kan., replacing **S. E. Scogin,** assigned to other duties.

Oscar R. Braden, section foreman on the Missouri-Kansas-Texas, at Parsons, Kan., has been promoted to terminal roadmaster at Parsons, succeeding **J. L. Couch,** who has been transferred to the Kansas City division, Glen Park terminal and Iola branch, with headquarters as before at Parsons, in place of **J. B. Carter,** assigned to other duties.

T. F. Scholes, supervisor of track on the Wilkes-Barre division of the Pennsylvania, at Reading, Pa., has been appointed supervisor of track on the Long Island at Jamaica, N. Y., succeeding **J. P. Hiltz, Jr.,** whose appointment as engineer of track of the Delaware, Lackawanna & Western is reported elsewhere in these columns. **W. R. Dunn,** assistant supervisor of track on the Pittsburgh division of the Pennsylvania, has been promoted to supervisor of track at Reading, replacing Mr. Scholes, and **R. V. Young,** assistant supervisor of track on the Conemaugh division, has been transferred to the Pittsburgh division, relieving Mr. Dunn.

J. W. Snyder has been appointed inspector and supervisor of bridges and buildings on the New York, Ontario & Western,, at Middletown, N. Y.

J. M. Jackson, supervisor of track on the Illinois Central, at Greenville, Miss., has retired. Supervision over Mr. Jackson's territory has been divided between **B. P. Brevard,** whose headquarters are at Clarksdale, Miss., and **M. A. Youngblood,** whose headquarters have been moved from Leland, Miss., to Greenville.

L. Stott, assistant roadmaster on the London division of the Canadian National, has been promoted to roadmaster at Palmerston, Ont., succeeding **Tom Morgan,** who has been transferred to Stratford, Ont. Mr. Morgan replaces **J. F. Sinclair,** who has been transferred to London, Ont., in place of **H. L. Wilkinson,** who has retired.

C. H. Hagen, a section foreman, at Chicago, on the Chicago & Illinois Western, a subsidiary of the Illinois Central, has been promoted to supervisor of track on the Illinois Central at Bluford, Ill., succeeding **J. C. Clapp,** who has been transferred to Reevesville, Ill., in place of **H. H. Fisher.** Mr. Fisher replaces **T. A. Robertson,** who has retired from his position as supervisor of track at Carbondale, Ill.

M. B. Kirschbaum, whose promotion to roadmaster on the Chicago, Milwaukee, St. Paul & Pacific at Terre Haute, Ind., was reported in the March issue, was born at Whittemore, Iowa, on November 5, 1892. After a grade school education, Mr. Kirschbaum entered the employ of the Milwaukee as a section laborer at Whittemore, in 1910. On Sept. 25, 1913, he was promoted to section foreman, serving on various sections of the Iowa & Dakota division until 1929, when he was appointed extra gang foreman. In this capacity and as general foreman he was employed on several divisions until his appointment as roadmaster at Terre Haute, effective February 15.

J. A. Blalock, assistant supervisor of track on the Richmond, Fredericksburg & Potomac at Richmond, Va., has been promoted to supervisor of track, Potomac yard, succeeding **G. A. Thomas,** who has been transferred to the main line as assistant supervisor, special duty, with headquarters at Richmond. **Allan G. Hunter,** material requisition and bill clerk in the chief engineer's office, has been promoted to assistant supervisor of track, Districts 1 and 2, with headquarters at Richmond.

Mr. Blalock was born at Richmond, Va., on March 20, 1915, and was graduated from Virginia Polytechnic Institute in 1937. He entered railway service in June, 1937, as an assistant on the engineer corps of the Pennsylvania at Philadelphia, Pa., later being transferred to Perryville, Md., Baltimore, Md., and Nor-

(Continued on page 398)

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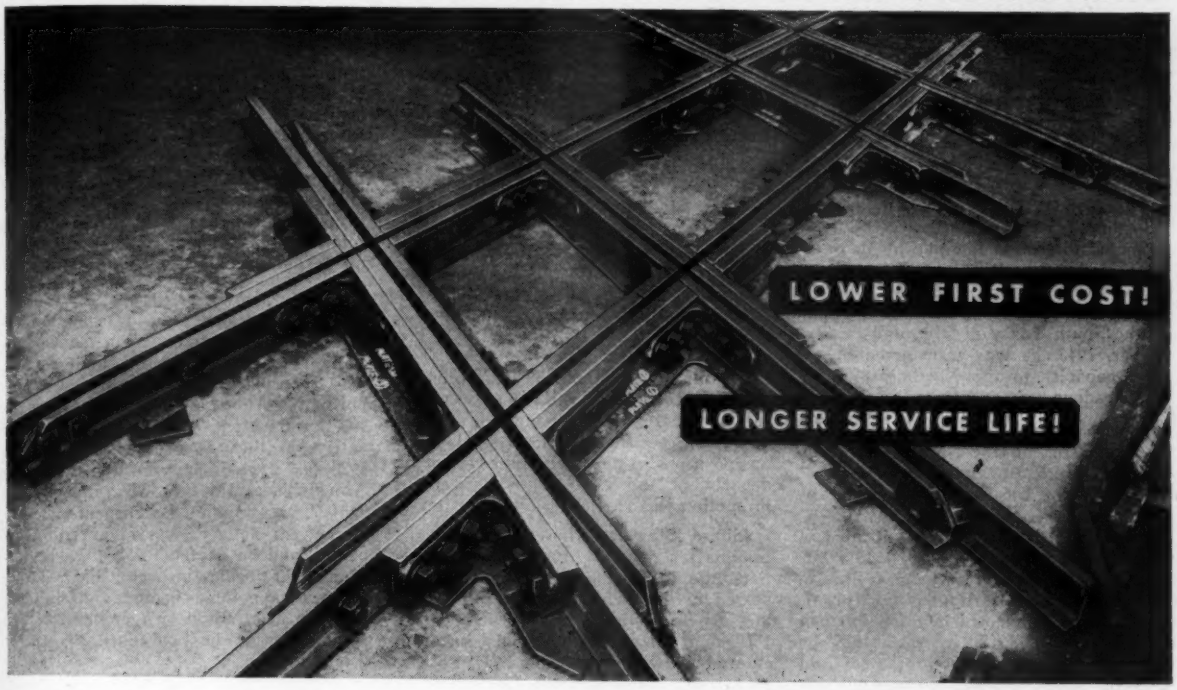

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ristown, Pa. In February, 1941, he was promoted to assistant supervisor of track at Columbus, Ohio, and later the same year, was transferred to Pittsburgh, Pa. In December, 1941, Mr. Blalock went with the Richmond, Fredericksburg & Potomac as assistant supervisor of track at Fredericksburg, Va., later being transferred to Richmond, and on January 1, 1945, he was advanced to supervisor of track, Potomac yard.

K. B. Wendt, extra gang foreman on the Northern district of the Missouri-Kansas-Texas, at Parsons, Kan., has been promoted to roadmaster at Oklahoma City, Okla., a newly created position. Mr. Wendt was born at Hemphill, Tex., on December 10, 1902, and, after a high school education entered railway service with the Katy as a section laborer at Eddy, Tex., on August 1, 1927. In September, 1928, he was advanced to assistant extra-gang foreman at Sealy, Tex., and in March, 1929, to assistant foreman, Houston, Tex., yards. Mr. Wendt was promoted to section foreman at Maxwell, Tex., in August, 1937, later being transferred to San Marcos, Tex. In April, 1942, he was made extra-gang foreman on the South Texas district, and in September, 1943, he was transferred in the same capacity to the Northern district, with headquarters at Parsons.

Charles Vernon Zeiss, whose promotion to roadmaster on the Sheridan division of the Chicago, Burlington & Quincy, at Gillette, Wyo., was reported in the February issue, was born at Red Cloud, Neb., on January 11, 1892, and was educated in the public schools of Red Cloud. Mr. Zeiss entered railway service as a section laborer with the Burlington on July 1, 1916, and was promoted to track foreman on September 1, 1918. In April, 1925, he was advanced to foreman of steel and ballasting gangs, and was subsequently advanced to track supervisor at Kenesaw, Neb., holding this position until his recent promotion.

E. C. Pirtle, whose promotion to supervisor of track of the Memphis Terminal division of the Illinois Central, with headquarters at Memphis, Tenn., was reported in the February issue, was born at Toone, Tenn., on May 21, 1890, and entered railway service as a section laborer on the Nashville, Chattanooga & St. Louis on July 18, 1911. On July 20, 1913, Mr. Pirtle went with the Illinois Central as track laborer on the Memphis Terminal division, being promoted to section foreman on September 6, 1913. On March 23, 1942, after serving variously as section and extra gang foreman, he was advanced to general track foreman at Memphis, remaining in this position until his recent promotion to supervisor of track.

Charles Anton Saxon, whose retirement as roadmaster on the Chicago & North Western, at Iron Mountain, Mich., was reported in the February issue, was born in Sweden on October 15, 1881, and entered railway service as a section laborer on the Chicago & North Western at Beechwood, Mich., in 1895. He was promoted to section foreman in 1903, at Beechwood, serving subsequently at Pentoga and Stager, Mich., and at Iron Mountain. In 1914, Mr. Saxon was advanced to general foreman at Stambaugh, Mich., and in 1916 he was further advanced to roadmaster, retaining this position until his recent retirement.

W. H. Wagner, whose promotion to roadmaster on the Chicago & North Western, at Fremont, Neb., was reported in the February issue, was born at Hadar, Neb., on October 17, 1889, and entered railway service on the Chicago & North Western as a section laborer on May 1, 1905. He was promoted to relieving foreman on September 1, 1908, and to section foreman at Lynch, Neb., on October 1, 1910, later serving at Colome, S.D., Hadar, Creighton, Newport, Long Pine, and Tilden, Neb. In 1932, Mr. Wagner was transferred to Norfolk, Neb., remaining in this position until his recent promotion.

Adrian H. Tolbert, whose promotion to roadmaster on the Atchison, Topeka & Santa Fe, with headquarters at Las Vegas, N.M., was reported in the February issue, was born at Miami, Tex., on February 20, 1906, and, after a high school education, entered railway service as a chainman with the Santa Fe at Pawhuska, Okla. During the years 1931 and 1932, Mr. Tolbert accepted a leave of absence from the Santa Fe to attend Texas Technical College, returning to railway service as a section laborer on the Santa Fe on May 16, 1932. Since that date he has held various positions in the track and engineering department, and at the time of his recent promotion was employed as a transitman.

Alonzo Stewart, whose retirement as roadmaster on the Atchison, Topeka & Santa Fe, at Albuquerque, N.M., was reported in the February issue, was born at New Bellsville, Ind., on September 26, 1879, and, after a high school education, entered railway service on May 1, 1899, as a track laborer on the Union Pacific at Delphos, Kan. He was promoted to relief section foreman in April, 1900, and to section foreman at Beloit, Kan., in 1904. In 1910 Mr. Stewart was made a general extra gang foreman, remaining in this capacity until September 15, 1918, when he went with the Santa Fe as yard section foreman at Albuquerque. On April 1, 1922, he was promoted to roadmaster at San Marcial, N.M., and in July, 1929, he was transferred to Albuquerque.

Bridge and Building

James J. Winn, assistant supervisor of bridges and buildings on the Boston & Maine, has been promoted to supervisor of bridges and buildings at Boston, Mass., succeeding **Foster R. Spofford,** whose promotion to assistant division engineer is reported elsewhere in these columns. **Murray I. Brown** has been appointed assistant supervisor of bridges and buildings at Boston.

Willard E. Crounse, whose promotion to bridge and building supervisor on the Champlain division of the Delaware & Hudson, with headquarters at Plattsburg, N. Y., was reported in the March issue, was born at Whitehall, N. Y., on July 12, 1900, and entered railway service on May 2, 1918, as a trainman and switchtender on the Saratoga division of the D. & H. In 1924 he became a carpenter helper on the same division and was later promoted successively to carpenter and master carpenter. In 1930, Mr. Crounse was appointed construction inspector, engineering department, with headquarters at Albany, N. Y., which position he held until his recent promotion.

John Calvin Davis, general foreman of bridges and buildings of the Richmond, Fredericksburg & Potomac, has been promoted to supervisor of bridges and buildings and his territory extended to include the Potomac yard.

J. H. McClure, whose retirement as bridge and building master of the Moncton division of the Canadian National, at Moncton, N. B., was reported in the March issue, was born at Moncton in 1886 and entered railway service at that point in 1904 as a messenger, later serving as a rodman and draftsman. In 1912 he was promoted to instrumentman and was later transferred to Truro, N.S. In 1916 he returned to Moncton as senior transitman. The following year he was promoted to bridge and building master there.

C. E. Garcelon, whose promotion to bridge and building superintendent of the Bangor & Aroostook, at Houlton, Me., was reported in the March issue, was born at Portage, Me., on September 25, 1907, and attended Bates College. He entered railway service in September, 1926, as a chainman on the Bangor & Aroostook, at Houlton, Me., and on May 9, 1927, was appointed a carpenter helper. Three years later he was advanced to carpenter, and on September 1, 1936, he was promoted to bridge inspector. Mr. Garcelon was appointed bridge and building foreman at Houlton on October 28, 1943, which position he held until his recent promotion.

Water Service

O. E. Mace, a chemist on the Pere Marquette, has been promoted to superintendent of water service, with headquarters at Grand Rapids, Mich.

Obituary

John L. Lash, assistant supervisor of track on the Pittsburgh & Lake Erie, at Beaver Falls, Pa., died recently. He was 41 years old.

Frederick Jasperson, 78, who retired in 1938 as manager of the Port Richmond terminals of the Reading, with headquarters at Philadelphia, Pa., and who for many years served as assistant chief engineer of the Reading and its predecessor company, the Philadelphia & Reading, died recently at Melrose Park, Pa. Mr. Jasperson, who had been in the employ of the Reading for 47 years prior to his retirement, served as a lieutenant colonel of engineers in World War I.

James C. Patterson, retired chief engineer maintenance of way of the Erie, whose death at Orange, N. J., on February 18, was reported in the March issue, was born at Carmichaels, Pa., on January 21, 1882, and was graduated from Penn-

(Continued on page 400)

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sylvania State College in 1905, entering railway service in June of the latter year as a rodman in the maintenance of way department of the Pennsylvania. In August, 1906, he became a draftsman on the New York Central & Hudson River (now part of the New York Central), and in April, 1907, entered the service of the Cleveland, Cincinnati, Chicago & St. Louis (Big Four), where he was engaged on location surveys. In October of the same

James C. Patterson

year, he became a field engineer for John C. O'Bryan, consulting engineer, remaining in that position until April, 1909, when he re-entered railway service as an assistant engineer on the Chicago Great Western. In July, 1913, Mr. Patterson was appointed chief draftsman on the Erie, and was promoted to assistant valuation engineer on May, 1916. He was made office engineer in February, 1917, and was promoted to principal assistant engineer in June, 1918. In March, 1920, he was promoted to regional engineer of the New York region, and in February, 1927, was further promoted to superintendent maintenance of way. In 1928 he was advanced to the position he held at the time of his retirement.

Onan Electric Generating Plants—D. W. Onan & Sons, Minneapolis, Minn., have published a pamphlet describing Onan a.c. and d.c. electric generating plants. A photograph and brief description of each model are given, along with specifications and ratings. Included also is a discussion of the principles to follow in determining the size electric power plant to purchase, and whether a.c. or d.c. current should be used.

Oxyacetylene Pipe-Line Installations—The Air Reduction Sales Company, New York, has recently published a 12-page booklet bearing this title, which, written by members of the company's applied engineering department, first outlines the economic advantages of a central distribution system for oxygen and acetylene. Following this there is a detailed discussion of the principles involved in the installation of pipe lines for the distribution of these gases. Included in the booklet also are a number of schematic diagrams showing piping layouts for typical plants, including a railroad shop.

Association News

Metropolitan Maintenance of Way Club

The next meeting of the club will be the annual meeting and will be held on April 26. The feature of the meeting will be an address by H. A. McAllister, assistant to president, Erie, who will discuss employee training with special emphasis on its application in the maintenance of way department.

Roadmasters' Association

The work of selecting the chairmen and members of technical committees to carry on the studies of the association during the current year has been practically completed, and most of the committees already have their work under way. However, a complete list of the committee personnel is not available and cannot be presented until a subsequent issue. To review the work done to date and to carry forward the routine activities of the association, President E. L. Banion has called a meeting of the Executive committee, in Chicago, on April 7.

Maintenance of Way Club of Chicago

The March meeting of the Club, with 158 members and guests in attendance, was held on March 26 in the Ambassador room of Huyler's Restaurant, Chicago, the feature of this meeting being an address by I. H. Schram, chief engineer maintenance of way, Erie, Cleveland, Ohio, who spoke on Employee Training.

Confining his remarks largely to the training of employees in the maintenance of way department, Mr. Schram first told of the long-standing efforts of his road in this regard, and then spoke factually, and in detail, concerning the more recent application of the Job Industry Training and Job Methods Training programs to the maintenance of way forces, from highest supervisory officers, to and including the individual trackman.

The next meeting of the Club, which will be held on April 23, will be the annual meeting, with election of officers, and will be preceded by an informal reception, beginning at 6:00 p.m. The speaker at this meeting will be A. C. Mann, vice-president, purchases and stores, of the Illinois Central System, Chicago, who will discuss Materials for Maintenance of Way.

Wood Preservers' Association

Owing to restrictions on conventions, the association has cancelled previous plans for an annual meeting, and will hold its Forty-First Annual Meeting by mail, supplemented by a special meeting of its Executive committee, to be convened at Chicago, on April 24. The purpose of the Executive committee meeting is primarily for the formal reception of reports and contributed papers, as well as to provide for the counting of election ballots, the installation of new officers, and the transaction of such other business as can be handled without the benefit of floor discussion. In connection with the election of officers, ballots were sent to all voting members before March 1, and these must be returned to the secretary prior to the Executive committee meeting. In the absence of a convention, preprints of all committee reports will be mailed to members, with an invitation for written criticism and discussion of all phases of the reports for publication in the 1945 Proceedings.

American Railway Engineering Association

In line with previously announced plans, the association did not hold its usual annual meeting in March. However, all committee reports that would otherwise have been presented before the meeting were reviewed by a special committee of the Board of Direction, and a letter ballot is to be mailed to all association members on April 3, by means of which they will be able to vote on the various committee recommendations on manual material.

During the second week in March the new Year Book of the association (Bulletin No. 452) was mailed to the members. As usual, this book contains a report of the president to the members, the annual reports of the secretary and the treasurer, and lists of members arranged alphabetically and by roads, as well as reference to other association matters.

Work on the makeup of committees and assignments of subjects for the ensuing year has now been completed by the Committees on Outline of Work and Personnel of Committees, and a booklet containing the assignments and personnel of committees will be mailed to all committee members during the first week in April. This booklet will show the following standing and special committees and their chairmen, as well as new subjects that have been assigned to those committees. Among the chairmen of the committees, those designated by asterisks have been newly appointed.

Roadway and Ballast—W. C. Swartout,* asst. engr., M.P., St. Louis, chairman. New subject—Electric shock fences and their adaptability to railroad requirements, collaborating with the Electrical Section, Engineering Division, A.A.R.

Ties—John Foley, head commodity specialist, Lumber and Lumber Products division, War Production Board, Washington, D.C., chairman.

Rail—W. H. Penfield, ch. engr., C.M.St.P.&P., Chicago, chairman.

Track—I. H. Schram, ch. engr., m. of w., Erie, Cleveland, Ohio, chairman. New subject—Effect of lubrication in preventing frozen rail joints.

Buildings—H. C. Lorenz,* asst. engr., C.C.C. &St.L., Cincinnati, Ohio, chairman. New subject—Color dynamics as an aid to efficiency.

Wood Bridges and Trestles—S. F. Grear,* asst. engr. of brdgs., I.C., Chicago, chairman. New subjects—Proper procedure to be followed in renewing creosoted timber ballasted deck trestles; design of creosoted timber pile piers for long spans; and specifications for inspection of timber trestle railway bridges.

Masonry—A. N. Laird, br. engr., G.T.W., Detroit, Mich., chairman.

Highways—A. P. Button, design. engr., N.Y.C., Chicago, chairman.

Records and Accounts—H. I. Restall, val. engr., B.&M., Boston, Mass., chairman.

Water Service, Fire Protection and Sanitation—V. W. DeGeer, engr. w.s., G.N., St. Paul, Minn., chairman. New subjects—New developments in lime-soda ash water softening plants and equipment; economies of silica removal from boiler feed water; and methods of removal of oily deposits from inside of locomotive boilers.

(Continued on page 402)

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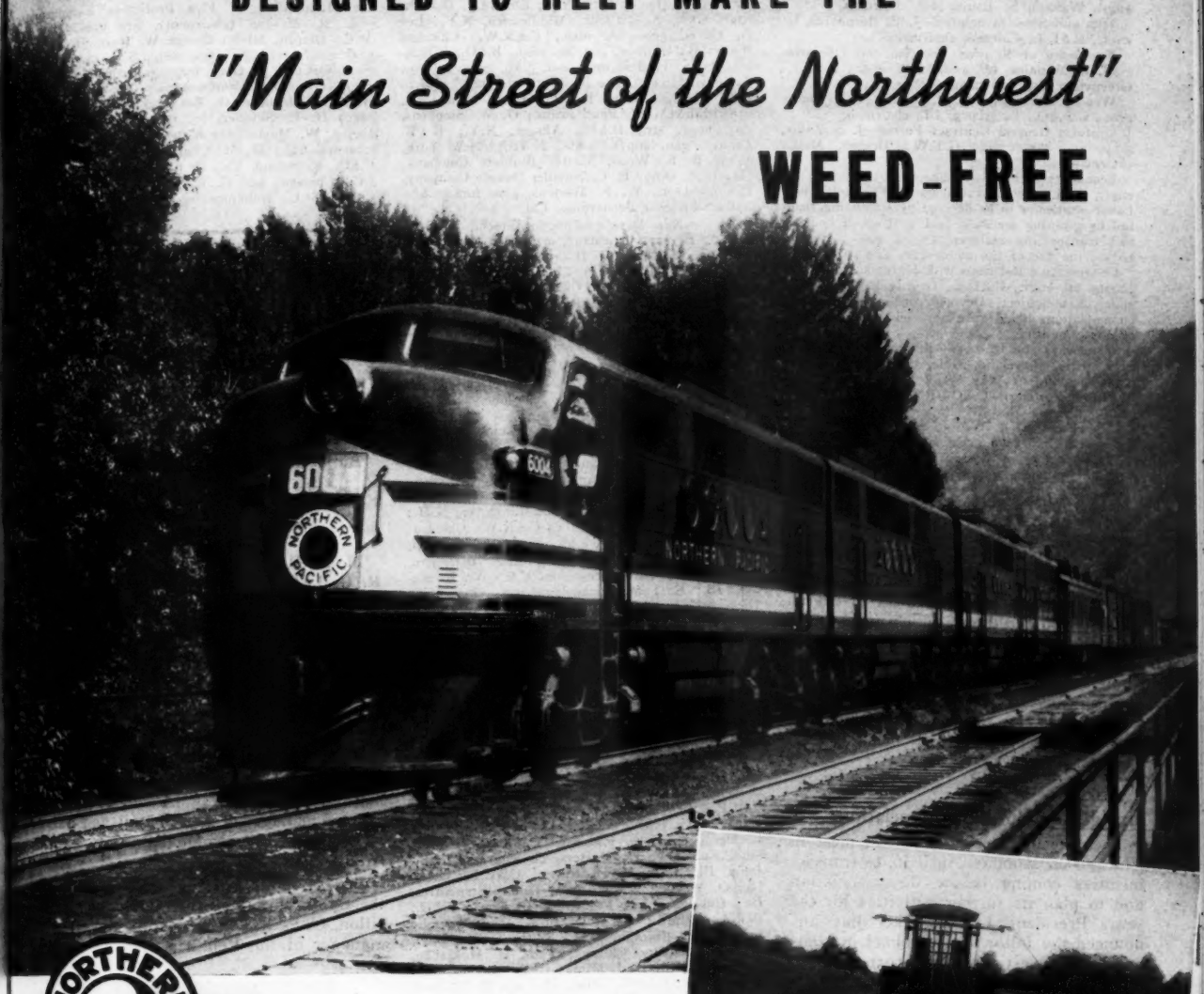

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Yards and Terminals—W. J. Hedley, const. engr., Wabash, St. Louis, Mo., chairman.

Iron and Steel Structures—J. E. Bernhardt, br. engr., C.&E.I., Chicago, chairman.

Economics of Railway Location and Operation—M. F. Mannion, off. asst. to ch. engr., B.&L.E., Greenville, Pa., chairman.

Wood preservation—H. R. Duncan, supt. timber pres., C.B.&Q., Galesburg, Ill., chairman.

Uniform General Contract Forms—J. S. Lillie, prop. and tax comr., G.T.W., Detroit, Mich., chairman.

Economics of Railway Labor—H. A. Cassil, ch. engr., P.M., Detroit, chairman. New subjects—Labor economies to be derived by stabilizing roadbed by grouting methods; and methods of housing and transporting maintenance of way forces to reduce the use of the motor cars and camp cars.

Co-Operative Relations with Universities—F. R. Layng, ch. engr., B.&L.E., Greenville, Pa., chairman. New subject—Develop conclusions and recommendations based upon a review of the reports of this committee.

Waterways and Harbors—Benjamin Elkind, off. engr., Erie, Cleveland, Ohio, chairman.

Maintenance of Way Work Equipment—C. H. R. Howe, cost engr., C.&O., Richmond, Va., chairman.

Clearances—A. R. Wilson, engr. br. and bldgs., Pa., Philadelphia, Pa., chairman.

Waterproofing of Railway Structures (special)—J. A. Lahmer, senior asst. engr., M.P., St. Louis, Mo., chairman.

Impact (special)—C. H. Sandberg, asst. br. engr. system, A.T.&S.F., Chicago, chairman. New subjects—Tests of viaduct columns; and determination of stresses and impacts in timber stringer bridges.

The only committee to meet in March was that on Buildings, which met at Cincinnati on March 14. Two committees are planning to hold meetings in April, these being the Committee on Track, which will meet in Chicago on April 12, and the Committee on Water Service, Fire Protection and Sanitation, which will meet at Chicago on April 17.

Bridge and Building Association

The Executive committee will meet in Chicago on Monday, April 16, to transact business coming before the association and to plan its further activities for the year. President J. L. Varker has announced the following personnel of committees to investigate and report upon the subjects now under consideration by the association, and these committees already have their work well underway. The subjects being considered, and the personnel of each committee are as follows:

No. 1—Economical Methods for the Maintenance of Impounding Reservoirs—K. J. Weir (chairman), supvr. fuel & w.s., C.M.St.P.&P., Chicago; J. P. Hanley (vice-chairman), w.s. insp., I.C., Chicago; C.R. Knowles, supt. w.s. (retired), I.C., Chicago; Guye Martin, supt. w.s., I.C., Chicago; Wiley Vernon Parker, ch. engrs. asst. U.S. Public Health Service, Memphis Tenn.; L. F. Pohl, div. engr., C.M.St.P.&P., Ottumwa, Iowa; M. P. Walden, asst. supvr. b.&b., L.&N., Evansville, Ind.; Shirley White, supvr. dam const., Bonita Dam, S.P., El Paso, Tex.; S. E. Bateman, w.s. fore., M.P., Poplar Bluff, Mo.; A. H. Frisbie, w.s. fore., C.&N.W., Sioux City, Iowa; L. A. Cowsert, water insp., B.&O., Dayton, O.; F. M. Ginter, w.s. fore., Alton, Bloomington, Ill.; Garry Smith, w.s. fore., N.Y.C., Rochester, N.Y.; G. H. Johnston, gen. fore. b.&b. & w.s., A.T.&S.F., Marceline, Mo.; Virgil Leak, gen. fore. b.&b. & w.s., St.L.-S.F., Tulsa, Okla.; A. N. Matthews, gen. fore. w.s. & b.&b., St. L.-S.F., Ft Scott, Kan.; D. M. Yaw, asst. supvr. b.&b., Erie, Youngstown, Ohio; and B. J. Howay, supvr. b.&b. & w.s., P.M., Grand Ledge, Mich.

No. 2—Restoring Old Masonry by Grouting, Including Surface Treatment Where Necessary—A. R. Harris (chairman), asst. engr. of br., C.&N.W., Chicago; J. S. Hancock (vice-chairman), br. engr., D.T.&I., Dearborn, Mich.; M. D. Carothers, ch. engr., Alton, Chicago; Armstrong Chinn, gen. mgr., Alton, Chicago; H. D. Curie, mast. carp., B.&O., Garrett, Ind.; Henry R. Dallery, supvr. b.&b., L.V., Jersey City, N.J.; Elmore J. DeWitt, engr. b.&b., N.Y.O.&W., Middletown, N.Y.; Leo D. Garis, gen. br. insp., C.&N.W., Chicago; Robert W. Gilmore, gen. br. insp., B.&O., Cincinnati, Ohio; Paul Haines, asst. b.&b. supvr., P.M., Saginaw, Mich.; Jesse S. Hyatt, ch. engr., C.N.S.&M., Chicago; Hans L. Larsen, str. iron fore., C.St.P.M.&O., St. Paul, Minn.; O. W. Stephens, asst. engr. str., D.&H., Albany, N.Y.; E. E. Tanner, gen. supvr. b.&b., N.Y.C., New York, N.Y.; B. R. Wood, Master Builders Company, Cleveland, Ohio; E. C. Neville, Dur-ite Company, Toronto, Ont.; W. F. Martens, gen. fore. b.&b., A.T.&S.F., San Bernardino, Cal.

No. 3—New Developments in Interior Painting—L. E. Peyser (chairman), prin. asst. arch., S.P., San Francisco, Cal.; T. H. Strate (vice-chairman), div. engr., C.M.St.P.&P., Chicago; F. W. Dayton, arch. drafts., C.&N.W., Chicago; K. E. Horning, arch. drafts., C.M.St.P&P., Chicago; A. C. Johnson, asst. supt. b. & b., E.J.&E., Joliet, Ill.; John Hayes, asst. arch., G.N., St. Paul, Minn.; Paul Knapp, mast. carp., Erie, Buffalo, N.Y.; W. A. Huckstep, gen. b. supvr., M.P., St. Louis, Mo.; A. B. Nies, arch., M.C., Detroit, Mich.; H. J. Powell, painter fore., N.Y.C., Malone, N.Y.; R. D. Baker (assoc. member), National Lead Company, New York, N.Y.; L. F. Flanagan (assoc. member), Detroit Graphite Company, Chicago.

No. 4—The Maintenance of Wood Bridges and Trestles—V. E. Engman (chairman), ch. carp., C.M.St.P.&P., Savanna, Ill.; F. R. Spofford (vice-chairman), asst. div. engr., B.&M., Dover, N.H.; A. E. Bechtelheimer, engr. br., C.&N.W., Chicago; L. G. Byrd, Sr., supvr. b.&b., M.P., Poplar Bluff, Mo.; G. S. Crites, div. engr., B.&O., Baltimore, Md.; O. F. Dalstrom, engr. br., C.&N.W., Princeton, Ill.; Carl M. Eichenlaub, res. engr., San Diego & Ariz. East., San Diego, Cal.; J. E. Hogan, asst. div. engr. C.&O., Hinton, W.Va.; V. W. Hutchings, b.&b. supvr., S.P., Bakersfield, Cal.; Sam Lincoln, gen. fore. b.&b. (retired), A.T.&S.F., Galveston, Tex.; Norman F. Podas, ch. engr., Minnesota Transfer Ry. Co., St. Paul, Minn.; J. W. Welch, supvr. b.&b., F.E.C., St. Augustine, Fla.; W. Walkden, br. engr., C.N.R., Winnipeg, Man.; and L. K. Arnold, div. br. insp., A.T.&S.F., San Bernardino, Cal.

No. 5—The Influence of Maintenance Practices on the Development of Modern Enginehouses—L. C. Winkelhaus (chairman), arch. engr., C.&.N.W., C.St.P.M.&O., Chicago; R. C. Baker (vice-chairman), supvr. b.&b., C.&E.I., Danville, Ill.; Frank Fackler, gen. fore. b.&b.&w.s., A.T.&S.F., Chanute, Kans.; F. H. Masters, ch. engr., E.J.&E., Joliet, Ill.; I. A. Moore, trmstr., C.&E.I., Salem, Ill.; O. M. Saxton, dist. mgr., Timber Structures, Inc., Chicago; L. P. Kimball, engr. bldgs., B.&O., Baltimore, Md.; P. R. Austin, Johns-Manville Sales Corp., Chicago; L. P. Keith, Timber Engineering Company, Chicago; Thos. D. McMahon, arch., G.N., St. Paul, Minn.; C. A. Hughes, asst. supvr. b.&b., E.J.&E., Joliet, Ill.; and H. E. Jackman, mast. carp., B.&O., Chillicothe, O.

No. 6—The Use of Highway Trucks in Bridge and Building Work ———— (chairman), H. F. Bird (vice-chairman), supvr. b.&b., N.Y.C., Syracuse, N.Y.; F. G. Campbell (vice-chairman), asst. ch. engr., E.J.&E., Joliet, Ill.; H. C. Crawford (vice-chairman), b.&b. supvr., S.P., Dunsmuir, Cal.; E. H. Barnhart, div. engr., B.&O., Garrett, Ind.; W. H. Begeman, asst. b.&b. supt., M.P., Falls City, Nebr.; H. R. Herrick, asst. b.&b. supvr., S.P., Bakersfield, Cal.; N. D. Howard, editor, *Railway Engineering and Maintenance*, Chicago 3; W. A. Hutcheson, supvr. b.&b., C.&O., Clifton Forge, Va.; P. L. Koehler, trmstr., C.&O., St. Albans, W.Va.; A. L. McCloy, b.&b. supvr., P.M., Saginaw, Mich.; E. W. Moore, mast. carp., C.B.&Q., Centerville, Iowa; S. R. Thurman, asst. b.&b. supvr., M.P., Nevada, Mo.; E. E. R. Tratman, civil engr., Wheaton, Ill.; John S. Vreeland, eastern editor, *Railway Engineering and Maintenance*, New York; H. F. Bennett, mast. carp., Erie, Dunmore, Pa.; and W. G. Kemmerer, engr. dept., Penna., Chicago.

No. 7—The Merits of Various Types of Piles—W. F. Martens (chairman), gen. fore. b.&b. & w.s., A.T.&S.F., San Bernardino, Cal.; J. P. Dunnagan (vice-chairman), engr. br., S.P., San Francisco, Cal.; J. R. Showalter (vice-chairman), br. engr., M.P., St. Louis, Mo.; A. B. Chapman, br. engr., C.M.St.P.&P., Chicago; D. W. Converse, asst. engr., A.C.&Y., Akron, Ohio; J. F. Seiler, prin. engr., A.W.P.A., Chicago; Joseph Smith, asst. b.&b. supvr., S.P., Sacramento, Cal.; Fred J. Stewart, port engr., Post Everglades Belt Line, Port Everglades, Fla.; J. R. Burkey, cons. engr., Union Metal Mfg. Co., Canton, Ohio, and Lee Mayfield, asst. engr. str., M.P., Houston, Tex.

No. 8—The Elimination of Fire Hazards and the Maintenance of Fire Protective Equipment—L. R. Morgan (chairman), fire prev. engr., M.C., Detroit, Mich.; George W. Rear, Jr. (vice-chairman), asst. gen. fire insp., S.P., San Francisco, Cal.; R. E. Dove, managing editor, *Railway Engineering and Maintenance Cyclopedia*, Chicago; B. M. Whitehouse, ch. fire insp., C.&N.W., Chicago; H. E. Skinner, br. insp., E.J.&E., Joliet, Ill.; J. W. Martin, fire & tunnel insp., S.P., Sacramento, Cal.; H. M. Church, gen. supvr. b.&b., C.&O., Richmond, Va.; C. E. Russell, supvr. w.s., I.C., Chicago; and C. R. Taggart, supvr. b.&b., C.C.C.&St.L., Indianapolis, Ind.

Supply Trade News

General

The **Pettibone Mulliken Corporation**, Chicago, has opened a new Chicago sales office at 141 West Jackson Blvd.

Builders Iron Foundry, Providence, R. I., has received its fifth Army-Navy E award.

Personal

M. E. Miller, district representative of **R. G. LeTourneau, Inc.,** Peoria, Ill., has been promoted to central sales manager, at Peoria.

Waldo E. Bugbee has been appointed representative of the **American Hoist & Derrick Company,** St. Paul, Minn., with headquarters in the Alamo National Building, San Antonio, Tex.

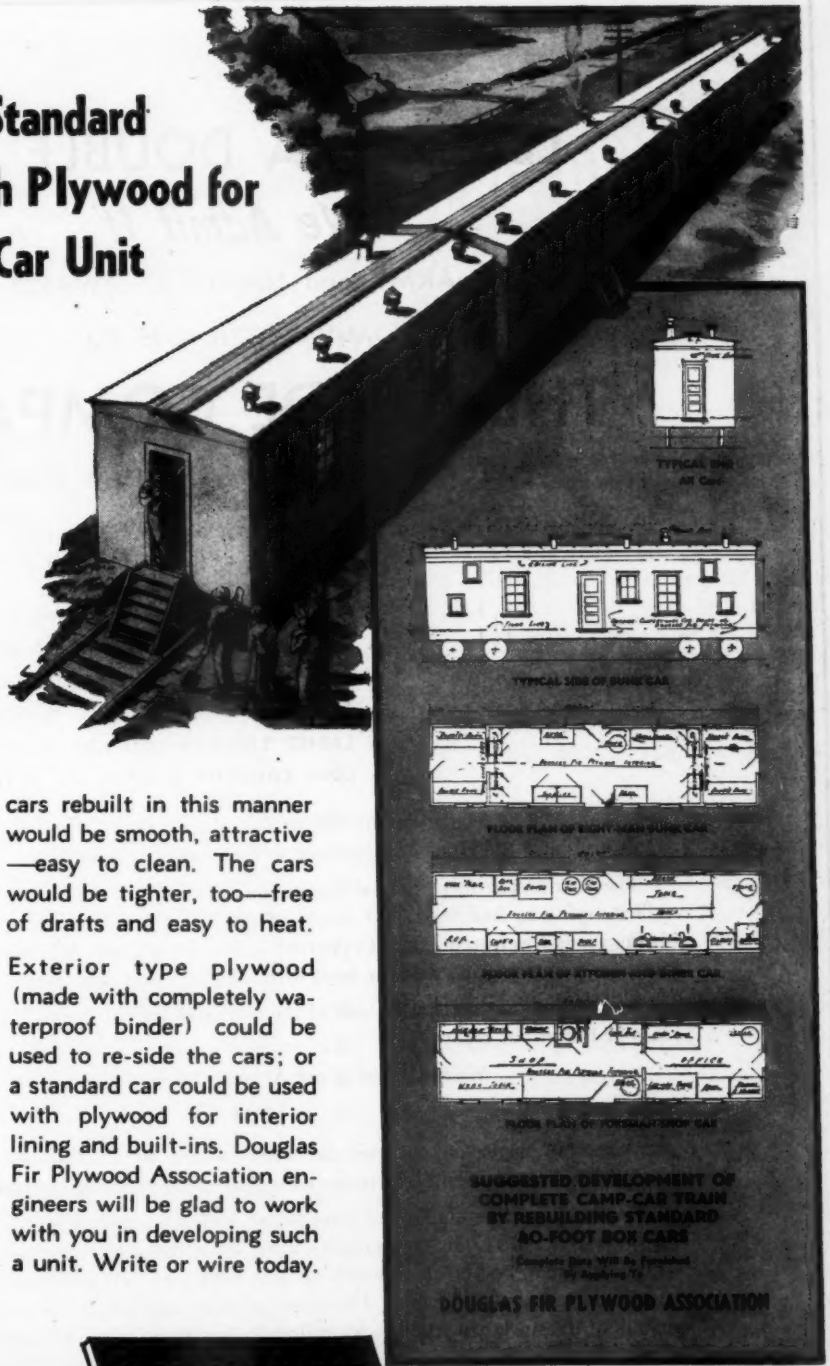
W. O. Robertson, assistant manager of the construction division of Armco Drainage & Metal Products, Inc., has been appointed manager of **Armco Railroad Sales Company,** with headquarters at Philadelphia, Pa.

E. D. Cowlin, general sales manager of the **Eaton Manufacturing Company,** Massillon, Ohio, has been appointed resident manager of the Reliance division of the

E. D. Cowlin

Eaton company. Mr. Cowlin entered the employ of the Eaton Manufacturing Company 21 years ago as manager of the New York office. In 1930 he was promoted to general sales manager at Massillon. In his new position, Mr. Cowlin will assume local supervision of both manufacturing and sales of all Reliance division operations in Massillon.

How to Rebuild Standard 40 ft. Box Cars with Plywood for a Complete Camp Car Unit

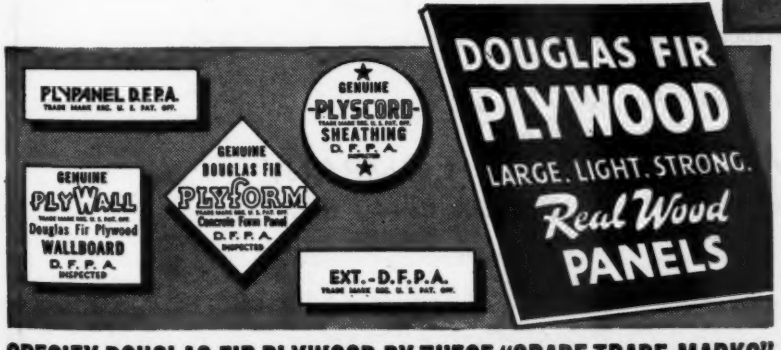


Three Standard Box Cars Are Transformed Into a Complete Camp-Car Train —Eight-Man Bunk Car, Foreman-Shop Car and Kitchen-Dining Car—With Durable Douglas Fir Plywood.

STUDY the plans at the right—and you'll see how simply three standard 40-foot box cars can be rebuilt to provide a complete camp-car unit. One car has bunk space for eight men. Another is a diner, with full kitchen facilities. The third is the foreman-shop car.

Douglas fir plywood—proven in hundreds of railroad uses — has many qualities which make it ideal for this type of work. It is durable, light in weight, strong and rigid. It is easily worked, either by hand or with power tools. It comes in large panel form—goes up quickly, with fewer seams and cracks. The interior of cars rebuilt in this manner would be smooth, attractive —easy to clean. The cars would be tighter, too—free of drafts and easy to heat.

Exterior type plywood (made with completely waterproof binder) could be used to re-side the cars; or a standard car could be used with plywood for interior lining and built-ins. Douglas Fir Plywood Association engineers will be glad to work with you in developing such a unit. Write or wire today.

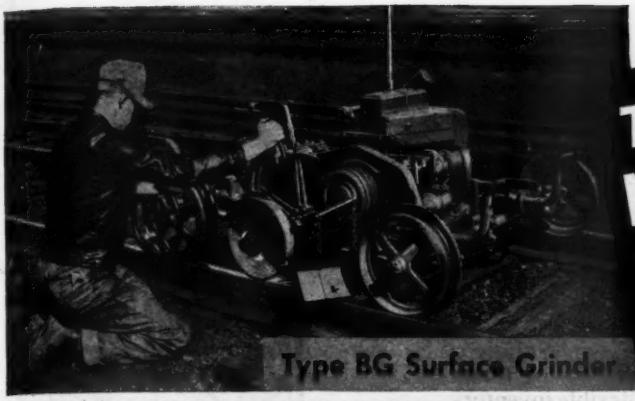


SPECIFY DOUGLAS FIR PLYWOOD BY THESE "GRADE TRADE-MARKS"

Douglas Fir Plywood is now available only on highest priorities. Application for allocation must be made by supplier to the War Production Board.

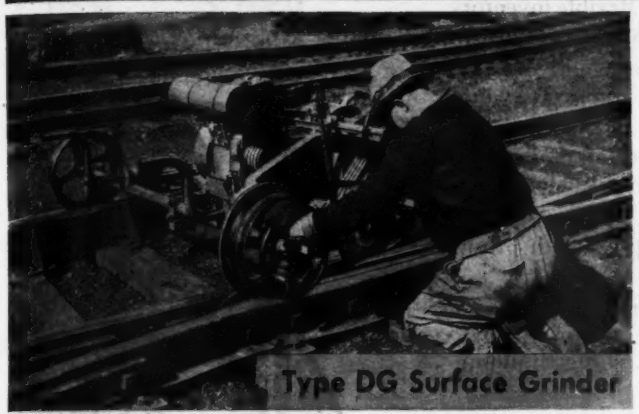
DOUGLAS FIR PLYWOOD ASSOCIATION

Tacoma 2, Washington



Type BG Surface Grinder

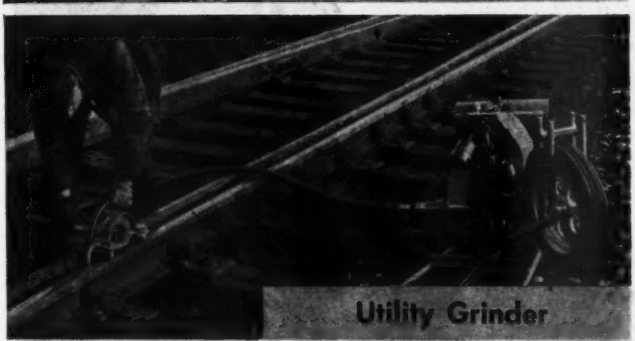
There is a type of NORDBERG GRINDER best adapted to your grinding jobs



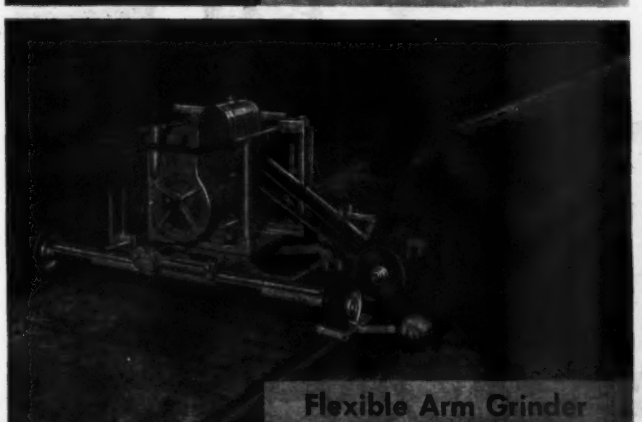
Type DG Surface Grinder

These five grinders were developed to meet your requirements wherever grinding is done in the maintenance of track. By the addition of the flexible shaft utility and the use of special Nordberg grinding accessories, these grinders are adaptable to a variety of grinding operations. You can do these jobs in less time, at lower cost and obtain a better quality of work when Nordberg Grinders are used.

- Removing flow at switchpoints and stock rails.
- Undercutting stock rail to house switchpoint.
- Grinding out corrugations and wheel burns.
- Grinding rail ends built up by welding.
- Removing humps from hardened rail ends.
- Grinding flangeways and frogs.
- Removing mill tolerance.
- Leveling cropped rail.
- Rail end slotting.



Utility Grinder



Flexible Arm Grinder

Midget Grinder

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Basically that's a railroad's business . . . buying and selling miles. Rolling stock represents an inventory of miles . . . a flexible inventory that can be stretched to your advantage with Flintkote Car Cements.

These asphalt-base compounds resist wear, abrasion and *corrosion.* They "plate" surfaces with resilient, long-wearing armor. They preserve strength for additional miles of pay load.

Today those miles are especially precious, and more and more maintenance men are discovering that Flintkote Car Cements help to keep cars out of the shop.

Flintkote Car Cements are easily and quickly applied with brush, trowel or spray . . . few hours and the job is done.

For over 40 years The Flintkote Company has served the railroad industry by supplying quality products in Car Cements, Asphalt Protective Coatings, Mastic Flooring, Insulation Coating, Building Materials.

Our Railway Division will be glad to send you full information, or to study any individual problems you may have.

TYPICAL APPLICATIONS OF FLINTKOTE CAR CEMENT

Underframes—all types of freight cars. Box Cars—outside roof . . . ends (side and end posts) . . . over coupler units at each end of floor line . . . inside, under wood lining (ends, sides and roof). Gondola Cars—over coupler units at each end of floor line . . . on underframes. Hopper Cars—underside of slope sheet . . . underframes . . . couplers.

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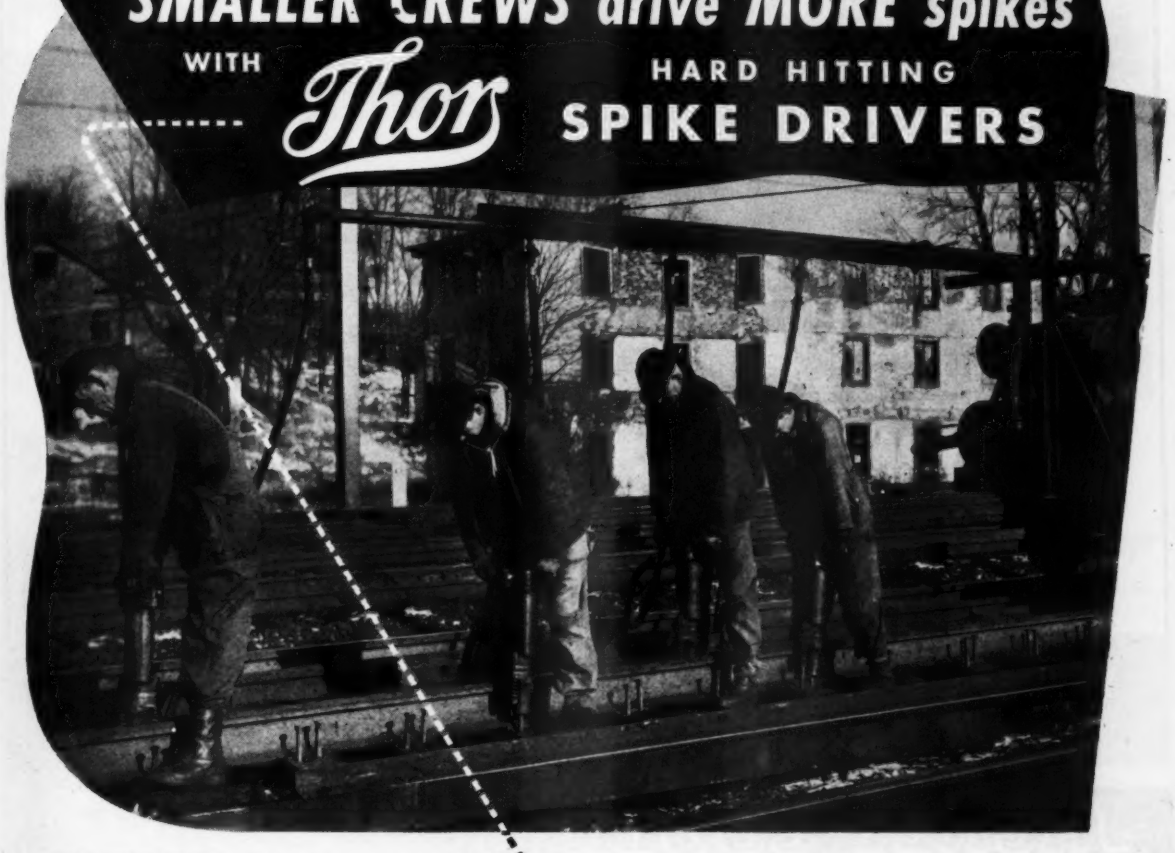
FLINTKOTE
INDUSTRIAL PRODUCTS

SMALLER CREWS drive MORE spikes

WITH Thor HARD HITTING SPIKE DRIVERS



THE PROBLEM of driving more spikes per hour, to match the speed of modern, mechanized track-laying equipment, was overcome by one large railroad, despite today's shortage of manpower.

The sturdy, powerful Thor pneumatic spike drivers which were put on the job (illustrated above) drove more spikes. Furthermore, the "balance" built into Thor spike drivers absorbs vibration and permits the driver to stay on the head of the spike, driving true and greatly reducing damage to spikes and tie plates. This same balance contributes to increased operator efficiency —more important today than ever before.

A Heavy-Duty machine, the Thor No. 25 Pneumatic Spike Driver delivers a very powerful blow, yet is easy to handle. This has been accomplished by the incorporation of the most recent advancements in design, including a new block-type piston hammer which greatly increases each foot-pound blow and a sturdy, four-bolt backhead which helps provide balance and absorb vibration. A comfortable rubber-covered handle and easy-riding qualities further contribute to the easy handling which results in more efficient work because of less fatigue to operators.

THESE POWERFUL AIR TOOLS SAVE TIME

Unskilled labor can be taught to drive spikes correctly in a very short time with Thor Spike drivers. Small crews can do a big job, faster and at less cost. For practical help in applying this modern method to your jobs, consult your Thor Service Engineer, or write for full details.

For more information on this and other modern Thor railroad maintenance-of-way equipment, send today for a copy of catalog No. 42A.

Other Thor tools for Maintenance-Of-Way

Paving Breakers	Riveting Hammers	Drills and Reamers
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With Burro Cranes

Burro Cranes are easy to handle, speedy and versatile. They're designed and built for railroad work—to do it faster, better, to save locomotive and work train hours in hauling and switching—to cut to a minimum the travel time between jobs—in short, to give you more crane hours on more different kinds of jobs under widely varying conditions. Burro Cranes not only pay their way with more and more continuous work, but they save you money besides in many items of operational expense.

Short Tail Swing
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Drawbar pull up to 7500 lbs.
Travel speeds up to 27 m.p.h.
Elevated Boom Heels
Low Overall height
Sets itself off and on track
Can be equipped for magnet, pile-driver, air-brakes, etc.

EVERY RAILROAD NEEDS BURRO CRANES

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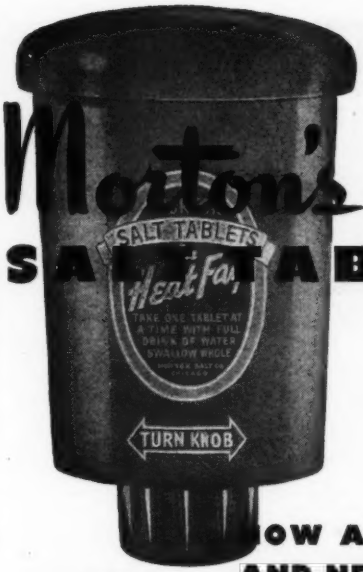

Morton's SALT TABLETS

...NOW AS FAMILIAR AND NECESSARY AS THE LUNCH PAIL...

It's the exceptional industrial plant that fails to provide salt tablets for its employees. Only a few years ago it was otherwise. Salt Tablets have become an industrial "must" for men who work — and sweat. Sweat robs the body of vital salt. This throws the body fluids out of balance. The result is Heat-Fag, inalertness, accidents, heat prostrations. The preventive is salt and water—water to restore the moisture lost in sweat, salt to restore the saline balance. Water alone won't do it. Both are needed.

The easy, simple, sanitary way to provide salt to workers who sweat is Morton's Salt Tablets available at every drinking fountain. The cost is less than a cent a man per week.

In salt tablets, as with other grades and types of salt, Morton is the recognized leader. Order Morton's Salt Tablets and Dispensers from your distributor or directly from this advertisement. Write for free folder. Morton Salt Company, 310 S. Michigan Ave., Chicago 4.

MORTON'S DISPENSERS

They deliver salt tablets, one at a time, quickly, cleanly — no waste. Sanitary, easily filled, durable.

800 Tablet size, $3.25

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Morton's Salt Tablets are available either plain or with dextrose.

Case of 9,000, 10-grain salt tablets - $2.60

Salt Dextrose Tablets, case of 9,000 - - $3.15

MORTON'S SALT TABLETS

SEALTITE HOOK BOLT

1 Fins prevent turning.
2 Fins seat without side pressure.
3 Drives easily.
4 Same size hole makes better installation.
5 Washer nut stops seepage and locks through nail hole.
6 Has reinforced hook.
7 Hook angle furnished to fit job.

Double Life
SEALTITE HOOK BOLTS

Because railroad trestles and bridges are constantly exposed to corrosive conditions we recommend the economy of ordering your hook bolts in the Sealtite Double-Life Hot-Dip galvanized finish sealing the bolt in zinc which retards all corrosion and saves expense of frequent replacement.

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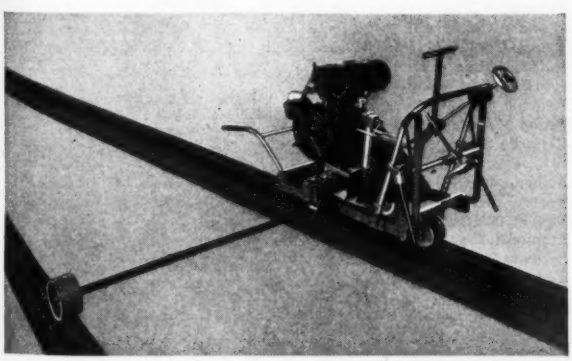
Good Track Maintenance Keeps 'Em Rolling Smoothly

Help keep pace with the heavy demands being made on tracks today with Railway Track-work Grinders. They quickly smooth rough track, accurately grind off overflowed metal from welded rail ends, frogs and switches. RTW grinders serve every track maintenance need. Write for latest data bulletins.



Railway Track-work Stock Rail Grinder, Model P-16, one of many models.

Railway Track-work Co.
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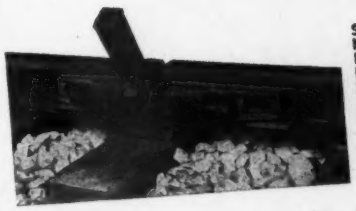
Why a Crew When One Man Can Do?



Simplex No. 550 Rail Puller and Expander, 25-tons capacity, 4½" to 8" expansion, 4½" to 8" pull, weight 87 lbs.

Joints can be properly spaced and rail ends, bolt and crossing damage prevented by one man with the Simplex Rail Puller and Expander. Service need not be interrupted when this tool is in use, as the alloy steel, heat-treated U-bar stiffens the joint, permitting train passage.

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HEAVY DUTY FLOOR PATCH

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NO WAIT FOR SETTING!

Use durable INSTANT-USE . . . a tough plastic material which you simply shovel into hole—tamp—and run traffic over immediately. NO WAITING. Bonds tight to old concrete. Makes smooth, solid, heavy-duty patch. Withstands extreme loads. Keep a drum on hand for emergencies. Immediate shipment.

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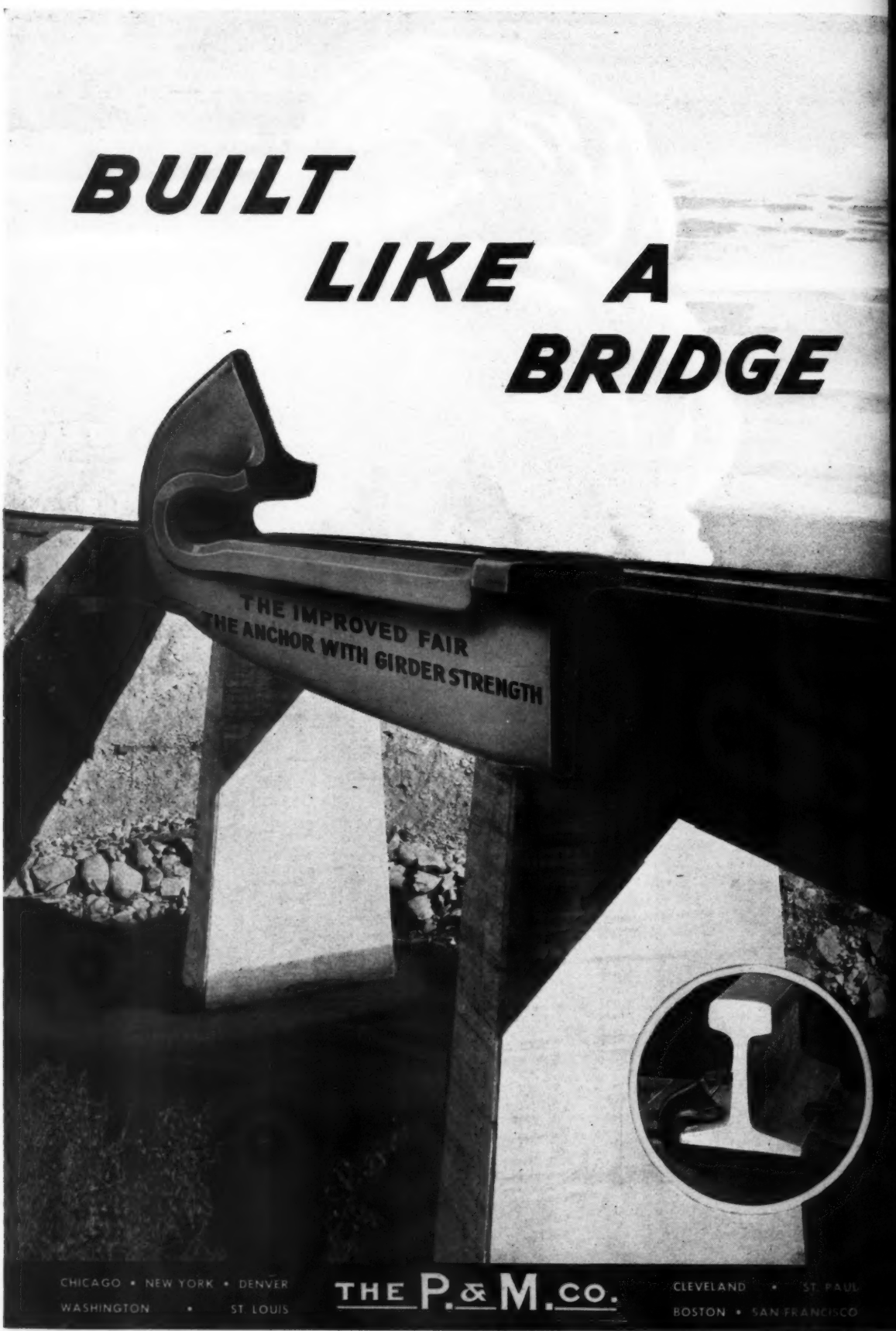
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